COMPARATIVE ADVANTAGE IN MANUFACTURING TRADE BETWEEN AUSTRALIA AND TAIWAN, 1965-94

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I, Amelia Ann Lindsay, hereby declare that this thesis is entirely my own work and that all sources used have been acknowledged.

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INTRODUCTION

1.1 Introduction

According to neoclassical trade theory, the law of comparative advantage determines the international pattern of specialisation in production.[1] This is particularly the case between countries with different relative factor endowments, tastes or technologies. The basis for comparative advantage between countries is relative differences in autarkic prices. Under free trade conditions, nations will tend to specialise in, as well as export, goods that have a relatively lower autarkic price, or a relatively lower opportunity cost, compared to another country. Goods that have a relatively higher autarkic price could be better imported, as opportunity costs are relatively higher. While this law is specified in terms of a two-country, two-factor and two-product model, it applies equally to a multi-nation, multi-factor and multi-product model with restricted trade, though in a less robust form (Deardorff 1980).

The measurement of comparative advantage is important to economists for several reasons. First, countries that specialise according to comparative advantage are said to maximise income and consumption through efficiency and welfare gains. These benefits are even greater when all nations refrain from policies that obstruct the impact of the law of comparative advantage. Second, the law reveals in what areas a country is relatively more competitive compared to another country. Third, it can be used to guide resource allocation from 'sunset' to 'sunrise' industries within countries. This may have implications for income re-distribution policies to assist displaced workers, especially following attempts to dismantle trade barriers (UNIDO 1986:3).[2]

[1] On the assumption, of course, that government policy does not distort underlying market forces and that markets are operating perfectly.

[2] Resource allocation, in the long run, tends to accord to comparative advantage following the

As a result of these and numerous other factors, frequent efforts have been made to empirically measure the theoretical concept of comparative advantage. The main problem facing empirical researchers of comparative advantage is that autarkic prices cannot be gleaned from a world long engaged in international trade. This means that researchers must use proxies for autarkic prices when estimating comparative advantage. This creates difficulties, since it cannot be determined whether the proxy chosen has a relationship with pre-trade prices when the latter is non-observable. Therefore, any empirical attempt at measuring comparative advantage requires an assumption that an observable variable can approximate unobservable phenomena.

The most common proxy of pre-trade prices in the comparative advantage literature is a country's trade performance. Intuitively, if a country was to have a comparative advantage in an industry, one would expect that industry to have a high outward orientation and hence a high export share relative to other industries. Similarly, industries with a comparative disadvantage would be expected to have a greater focus towards the domestic market with relatively high import volumes. Trade flows have the ability to reflect costs and non-price variables (such as quality), which are generally considered to be the main factors affecting comparative advantage.[3] This is the logic behind Revealed Comparative Advantage (RCA) indices developed by Balassa (1965). Such indices are purported to reveal a comparative advantage in industry i for country j when the share of industry i's exports in country j's total exports exceeds the share of world exports for industry i in total world exports.[4]

An alternative insight into comparative advantage can be gleaned from two of its main determinants, relative labour productivity and price levels.[5] While relative factor endowment differences (Heckscher-Ohlin trade theory) are more commonly used as an explanation of comparative advantage, relative labour productivity levels

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introduction of trade liberalisation policies (Balassa 1965:41).

[3] This is important since it is not possible to develop a measure that can account for all factors influencing comparative advantage.

[4] Refer to page eight.

[5] This is based on the classical Ricardian trade theory, which postulated that relative labour productivity levels were the main determinant of comparative advantage.

provide an important insight for several reasons.[6] First, unlike capital, labour is a relatively immobile factor of production (Golub 1995:6). Second, measures of labour productivity levels are far more reliable than estimates of capital productivity levels. Third, figures for gross value added per person employed and hour worked are more widely available than estimates of capital stock.

Despite the obvious advantages of gleaning comparative advantage from relative labour productivity levels, there are important problems with this approach. Labour productivity levels must be expressed in a common currency before they can be compared between countries. Exchange rates generally should not be used as a conversion factor because speculative capital flows prevent them from reflecting the purchasing power parity of currencies. Therefore, an alternative conversion factor is required if labour productivity levels are to be accurately compared between countries. The industry-of-origin approach, popularised by the International Comparisons of Output and Productivity (ICOP) and Comparison of Output, Productivity and Purchasing Power in Australia and Asia (COPPAA) projects at the Universities of Groningen and Griffith respectively, is a more reliable alternative to exchange rates.[7] This methodology is based on a match of unit values at a product level between countries that are subsequently weighted with industry, branch and sectoral value added to yield purchasing power parities at each of the three tiers of production.

This thesis will attempt to measure comparative advantage using both of the methodologies described above. Comparative advantage will therefore be assessed using both determinants of comparative advantage, relative labour productivity and price levels, and an outcome of comparative advantage, international trade flows. This concept may be expressed as follows:

[6] The Heckscher-Ohlin trade theory postulates that nations abundantly endowed in a factor of production (such as labour or capital) will tend to have exports that make intensive use of that factor in their production.

[7] The expenditure approach has also been used for this purpose by the OECD and Eurostat, but cannot be used to compare productivity levels at a sectoral, branch and industry level of manufacturing production due to its focus on income aggregates such as consumption and investment.

Relative labour productivity and price levels → Comparative Advantage ← trade volumes

The focus of the empirical measurement of comparative advantage will be between Australia and Taiwan. Taiwan was compared with Australia for several reasons. First, Taiwan has become one of Australia's most important trading partners within the Asian-Pacific region.[8] Second, the ICOP and COPPAA projects have yet to conduct an industry-of-origin study for Taiwan relative to Australia. Third, no RCA study has been conducted between Australia and Taiwan. The present study therefore aims to make an important contribution to both the ICOP and COPPAA, as well as to the RCA, literature.

Comparative advantage between Australia and Taiwan will be measured in terms of manufacturing. This is essentially the only sector of Taiwan's economy that can be compared with Australia as a result of Taiwan's poor endowment of natural resources.[9] Moreover, the industry-of-origin approach encounters problems when measuring labour productivity in sectors where it is difficult to impute a market value, such as services.

1.2 Purpose of the Present Study

The basic questions this thesis will address are:

1. Where does comparative advantage exist between Australia and Taiwan?

2. How has comparative advantage changed between Australia and Taiwan?

3. Do RCA index values and relative labour productivity levels display consistent results?

[8] In 1994, Taiwan was Australia's sixth most important trading partner, compared to 13th in 1975.
[9] In 1995, 95 per cent of Taiwan's exports to Australia were in the form of manufactures.

1.3 Thesis Structure

Chapter two will review the literature on the RCA index and industry-of-origin approaches. The RCA review will discuss the development of this concept by Balassa (1965), as well as the advantages and disadvantages of this approach. It will also review the results of some RCA studies that involve Australia. For the review of the industry-of-origin approach, the methodology used by the ICOP project at the University of Groningen will be outlined. The advantages and disadvantages of the industry-of-origin methodology will then be discussed, followed by a review of Australian industry-of-origin studies conducted by the COPPAA project at the University of Griffith.

Chapter three will discuss the role played by manufacturing and foreign trade in Australia and Taiwan. Shares of Gross Domestic Product (GDP), employment, exports and imports will each be used to indicate the relative importance of manufacturing, while the trade intensity ratio will reveal the relative contribution of foreign trade, between 1965 and 1994. Chapter three will then discuss the relative importance and the composition of trade between Australia and Taiwan over the same period. Government trade related policies will also be reviewed, as this is the main factor preventing trade flows from revealing comparative advantage.

Chapter four will present RCA index values for Australia and Taiwan at an industry level of manufacturing trade. The RCA index values will be computed over four periods, 1965-67, 1972-74, 1982-84 and 1992-94, to determine changes in comparative advantage over time. To simplify the interpretation of results, industry RCA index values will be aggregated according to their most intensively used factor of production - human capital, technology, unskilled labour or natural resources. The final section of chapter four will determine whether comparative advantage had become more complementary or competitive between 1965-67 and 1992-94, again using RCA index values.

Chapter five will develop unit value ratios to determine the labour productivity and price performance of Taiwan relative to Australia using the industry-of-origin approach. Labour productivity levels will be presented in terms of gross value added per person employed and gross value added per hour worked, while relative price levels will be interpreted in terms of purchasing power parity and exchange rate ratios. All results will be presented at a sectoral and branch level of manufacturing production. Subject to data availability, extrapolations of gross value added per person employed and relative price levels will be limited to years between 1974 and 1995, while this will be the case for gross value added per hour worked between the years 1975 and 1992. The specific problems involved with the industry-of-origin approach between Australia and Taiwan will also be discussed.

The final chapter will compare the results of the RCA index values and relative labour productivity levels. The purpose of this exercise will be to determine whether relatively high export shares are necessarily associated with relatively high level of labour productivity.[10] The last section of chapter six will then conclude and summarise the main findings of the present study.

[10] See Balassa (1963) and Golub (1995).

- CHAPTER TWO -

REVIEW OF REVEALED COMPARATIVE ADVANTAGE AND INDUSTRY-OF-ORIGIN LITERATURE

2.1 Introduction

In the absence of autarkic prices, it is necessary to use alternative measures of comparative advantage. For the purpose of the present study, revealed comparative advantage (RCA) index values and the industry-of-origin approach were chosen for this purpose. This thesis will therefore begin with a review of the RCA and industry-of-origin methodology. Each review will be followed by a discussion of their benefits and drawbacks, as well as their application in Australia and Taiwan. The final section will conclude and summarise the chapter.

2.2 The Concept of 'Revealed' Comparative Advantage

2.2.1 The Balassa Interpretation of Comparative Advantage

The RCA concept was developed by Balassa (1965) to assess how tariff reductions would affect resource allocation in the long run. Balassa reasoned that trade flows can approximate comparative advantage, given that they are able to reflect the main determinants of trade patterns such as relative costs and non-price factors. Balassa was inspired by Liesner (1958), who used export shares to show how European integration would impact on British manufacturing industries. According to Liesner, a high export share relative to European competitors represented a comparative advantage and therefore potential gains from European integration. However, Balassa argued that export shares should be adjusted for differences in country size before it is possible to glean comparative advantage.

Balassa developed two indices based upon the concept of revealed comparative advantage. The first index, termed by Balassa as the export performance ratio, is expressed as

(1) $$EPR_{ij} = \frac{X_{ij}}{\sum_{j} X_{ij}} \Bigg/ \frac{\sum_{i} X_{ij}}{\sum_{i}\sum_{j} X_{ij}}$$

Where

EPR_{ij} = Export performance ratio for industry i in country j

X_{ij} = Exports of industry i from country j

$\sum_{j} X_{ij}$ = Total exports from country j

$\sum_{i} X_{ij}$ = Total world exports from industry i

$\sum_{i}\sum_{j} X_{ij}$ = Total world exports from all industries

According to Balassa, a comparative advantage is revealed when the EPR exceeds unity. That is, when the average export share of industry i in country j exceeds the average export share of industry i in total world exports, country j will reveal a comparative advantage in industry i. Similarly, a value below unity denotes a comparative disadvantage. The value of the RCA index was assumed by Balassa to be proportional to comparative advantage, where a higher or lower RCA index value was associated with a stronger or weaker comparative advantage when its value exceeded unity. The RCA index values are usually interpreted as a two-year or three-year average so that annual fluctuations do not unduly influence results.

The second index developed by Balassa, termed the export-import ratio, was based on a ratio of net exports to total trade for an industry. Algebraically, the index is expressed as

(2) $$NX_{ij} = \frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}}$$

Where

NX_{ij} = Export-import ratio for industry i in country j

X_{ij} = Exports of industry i from country j

M_{ij} = Imports of industry i from country j

An export-import ratio above unity is purported to reveal a comparative advantage when the net export share of industry i in country j is greater than the total trade share of industry i in country j. This is a more theoretically consistent measure of comparative advantage as it takes account of intra-industry trade. However, the export-import ratio tends to be more susceptible to the influence of protectionist policies than the export performance ratio (UNIDO 1986:5-6).

2.2.2 Alternative RCA Indices

Balassa's export performance and export-import ratios spurred the development of other RCA indices, although his remain the most widely used measures of comparative advantage. H. Bowen (1983) developed two net export indices based on a neutral comparative advantage world with uniform autarkic prices. Deviations from this benchmark were assumed to reflect a comparative advantage or disadvantage. Other cruder indicators, such as ratios of exports/imports to production/consumption and production as a share of consumption, have also been used in the literature to measure comparative advantage (Ballance 1988:11). These ratios are rarely used in the RCA literature to measure comparative advantage, primarily because it is difficult to concord trade and production data that are based on inconsistent classifications (Ballance, Forstner and Murray 1987:158).

2.2.3 Validation of RCA Index Values

Given the widespread use of RCA indices in measuring comparative advantage, numerous attempts have been made to establish their relationship. Yeats (1990) found RCA indices were consistent with the predictions of the Hecksher-Ohlin trade

model, as high values were observed for labour-intensive industries in labour-abundant developing countries. A model developed by Marchese and Nadal De Simone (1989) showed the Balassa export performance index values conformed well with approximations of relative autarkic prices. Similarly, a model developed by Deardorff (1980) established a relationship between approximated relative autarkic prices and net exports when trade flows were assumed to be unimpeded.

2.2.4 Criticisms of RCA Index Values

Despite these attempts to validate the use of RCA indices, a considerably greater volume of the RCA literature is devoted to highlighting their deficiencies. Three main shortcomings have been identified in the RCA literature. First, the relationship between observed trade flows and approximated autarkic prices was questioned. Webster (1990:300) argued that Deardorff's finding of a relationship between approximated autarkic prices and net exports is of limited use in a world where extensive trade barriers prevail. Drabicki and Takayama (1979) found the relationship between approximated autarkic prices and net exports broke down when more than two countries, two factors and two products with trade impediments were included. Hillman (1980) and Yeats (1985) discovered the Balassa export performance results were independent of approximated autarkic prices when ranked across industries within a nation.

Second, the degree of consistency between various RCA index values has been disputed. This finding is problematic as every RCA index purports to measure comparative advantage. Ballance, Forstner and Murray (1987:161) found that RCA index consistency depended on whether they were interpreted as an ordinal, cardinal or dichotomous measure of comparative advantage.[1] According to Yeats (1985), interpretations of RCA index values in terms of a country rank for an industry or

[1] An ordinal interpretation of RCA index values measures the degree to which RCA index values deviate from unity, a cardinal interpretation ranks RCA index values for countries with respect to an industry or industries within a country, while a dichotomous interpretation is where an industry is perceived as having a comparative advantage or disadvantage (RCA index value is above or below unity) (UNIDO 1986:7).

across industries for a country was the main cause of inconsistency between RCA index values.

Third, distortions created by government policies were a common complaint of RCA studies. Balassa (1977:327), Ariff and Hill (1985a: 226), UNIDO (1986:6), and Tyers and Phillips (1985:85) all noted that government policies have the potential to prevent RCA index values from reflecting underlying comparative advantage. Each of the authors acknowledged this distortion could be reduced by only using RCA indices based upon exports, given that import policies are more widely used by governments to influence trade flows. Balassa (1977:63) himself condoned this view, eventually preferring the exclusive use of his export performance ratio to the export-import ratio on these grounds.[2]

2.2.5 Australian RCA Studies

A review of the literature indicates that only a limited number of studies have used RCA index values to assess comparative advantage in Australia. The majority of RCA studies have focused on the East Asian and the Association of South East Asian Nations (ASEAN) regions.[3] Only three studies have examined comparative advantage using RCA index values for Australia, with no studies examining comparative advantage for Australia on a bilateral basis. Moreover, no RCA studies have involved Taiwan.

The first study to use RCA index values to assess Australia's comparative advantage within the Asian-Pacific region was by Tyers and Phillips (1985). Their study found that Australia had an RCA index value below unity for unskilled labour-intensive, technology-intensive and human capital-intensive goods. Only in the case of agricultural-intensive and mineral resource-intensive goods were RCA index values found to exceed unity.

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[2] This is not to say that export-based RCA indices are completely free from the influence of government policies. Import policies of the destination country and the export policies of the home country create important distortions to this index.

[3] See Tyers and Phillips 1985; Ariff and Hill 1985a, 1985b; Rana 1988; Mikic, Palac-McMiken and

The second study, by Ratnayake (1990), used RCA index values to examine comparative advantage in the Australian manufacturing sector from 1970 to 1985. Ratnayake found Australia's comparative advantage was concentrated in technology-intensive and human capital-intensive manufactures. This result was supported by Huey (1993), who examined comparative advantage in the Australian manufacturing sector between 1978-79 and 1988-89.

Several deficiencies were identified by the review of Australian RCA literature. First, the results of these studies are now quite dated. The latest date for an RCA analysis was in 1988/89. Second, the Australian studies only examined comparative advantage over a ten-year period, which may be considered as too short to observe conclusive changes in comparative advantage. Third, the RCA studies tended to examine comparative advantage on a multilateral, rather than a bilateral, basis.

2.3 The Industry-Of-Origin Approach

2.3.1 The Industry-of-Origin Methodology

A comparison of labour productivity levels between countries requires that gross value added per person or hour worked be denominated in a common currency. Intuitively, the most appropriate conversion factor for this exercise is the market exchange rate. This is based upon the assumption that exchange rates reflect the law of one price, where arbitrage ensures an equalisation of prices across countries. However, the prevalence of speculative capital flows, factor immobility, government-imposed trade restrictions and differences in demand patterns across countries, prevent exchange rates from reflecting relative purchasing power between countries (Van Ark and Pilat 1993:1; Van Ark and Maddison 1994:1).

The deficiencies of market exchange rates, in terms of accurately reflecting relative purchasing power across countries, have been responsible for the widespread use of

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Ratnayake 1994a, 1994b; Huey 1993; Lee 1995.

alternative conversion factors. The most widely used conversion factor for expressing labour productivity levels in a common currency is expenditure-based purchasing power parities, or what is more widely known as the expenditure approach. This approach has been used exclusively since the 1970s by the International Comparison Project (ICP) in the United Nations, Eurostat and the OECD, where prices for GDP income components, such as investment and consumption, are compared between countries. This means that labour productivity levels can only be compared at an economy-wide level, rather than at a sectoral, branch or industry level of production. Moreover, the expenditure approach incorporates import prices, trade and transport margins while excluding export prices and intermediate goods. Therefore, approximations of real product by industry may be seriously compromised by the use of the expenditure approach (Van Ark and Maddison 1994:1-2,4).

To avoid these problems, the labour productivity literature has tended to employ the industry-of-origin approach for sectoral, branch and industry comparisons of labour productivity levels. This approach was developed by Rostas (1948) and Paige and Bombach (1959) [cited in Van Ark (1993:15)] and was only recently revived by the establishment of the International Comparisons of Output and Productivity (ICOP) project at the University of Groningen in 1983.

The industry-of-origin approach has been utilised in one of two ways in the labour productivity literature. Purchasing power parities are either based on a ratio of physical quantities using prices of either country as weights, or a ratio of unit values (price divided by quantity) using quantities of either country as weights, for matched pairs of products between two countries (Maddison and Van Ark 1994:12).[4] The physical quantity method has become less utilised as a result of the progressive rise in the number of products. This is because matched quantities are not usually considered to be an accurate representative of unmatched quantities for manufactured goods. Thus, the quantity method is mainly used when price data is unreliable or

[4] Early industry-of-origin studies, such as those conducted by Rostas and Paige and Bombach (cited in Van Ark 1993:15), used the physical quantity approach.

incomplete.[5] As a result, the unit value ratio approach is the most commonly used industry-of-origin procedure in the labour productivity literature. This is an important assumption, given that only a small percentage of products can be matched between a pair of countries, for reasons outlined below (Van Ark 1993:13-14).

To utilise the industry-of-origin approach, a stage-like approach must be adopted. First, it is necessary to identify identical, or at least highly similar, industries and branches between a pair of countries. Second, the products within these industries considered to be identical are matched between the two countries. This can be achieved in one of three ways. The first method is the maximalist approach, where an attempt is made to match as many identical products as possible. The second method is the minimalist approach, where products are ranked according to gross output share and then matched if their share exceeds one per cent. The third method is the Van Ark, Blades and Maddison (A-B-M) approach, which maximises the output coverage for a minimum number of product matches (De Jong 1994:7).

Using one of the three methods outlined above, the third stage of the industry-of-origin approach involves aggregating matched products to form a unit value ratio at an industry level, using sales quantities of either country as weights, as shown by equation three and equation four.[6] Therefore, a bilateral comparison of productivity levels involves the construction of two industry unit value ratios, being equivalent to Laspeyres and Paasche index numbers. The spread between index numbers that tends to arise when using quantity weights of different countries can be attributed to the "Gerchenkron" effect (Van Ark and Pilat 1993:9). This effect arises when a relatively low quantity unit in one country leads to relatively higher quantity weights in the comparator country and hence relatively higher unit value ratios (Van Ark 1993:30). The use of a Fisher index, or the geometric average of both indices, can assist in smoothing this influence, as shown by equation five.[7]

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[5] The quantity method is also utilised in comparisons of agricultural productivity levels between countries. See Prasada Rao (1993).

[6] This procedure, listed in almost all ICOP and COPPAA publications, ensures 'outlier' unit value ratios do not markedly influence the overall result by weighting industries according to their output share (Van Ark 1993:46).

[7] Differences between the two index numbers tend to arise particularly when comparing productivity

(3) $$UVR^{XU(U)} = \frac{\sum_{i=1}^{s_j} P_{ij}^{X} * Q_{ij}^{U}}{\sum_{i=1}^{s_j} P_{ij}^{U} * Q_{ij}^{U}}$$

(4) $$UVR^{XU(X)} = \frac{\sum_{i=1}^{s_j} P_{ij}^{X} * Q_{ij}^{X}}{\sum_{i=1}^{s_j} P_{ij}^{U} * Q_{ij}^{X}}$$

(5) $$UVR^{Fisher} = \sqrt{UVR^{XU(X)} * UVR^{XU(U)}}$$

Where

$UVR^{XU(U)}$ = Industry unit value ratio for country X using U as a base country

$UVR^{XU(X)}$ = Industry unit value ratio for country X using X as a base country

UVR^{Fisher} = Fisher index of industry unit value ratios for both country X and country U

P_{ij}^{X} = Unit value (price divided by quantity) for a matched product within industry i for country X

Q_{ij}^{X} = Quantity of a matched product within industry i in country X

P_{ij}^{U} = Unit value for a matched product within industry i in country U

Q_{ij}^{U} = Quantity of a matched product within industry i in country U

There is a general consensus in the ICOP literature that between 25 per cent and 30 per cent of total output should be matched before an industry unit value ratio for matched output is considered to represent a unit value ratio for unmatched output.[8] This is a strong assumption given that as much as 80 per cent of total output usually cannot be matched between a pair of countries. Products within industries that do not meet this threshold are allocated the branch unit value ratio for that industry (Pilat, Prasada Rao and Shepherd 1993:7).

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levels between developed and developing countries. This is largely due to differences in price, output and production structures (Shepherd and Prasada Rao 1997:7).

[8] Although the threshold where matched output becomes representative of unmatched output is difficult to determine, most industry-of-origin studies take the figure to be between 20 and 25 per cent.

The construction of unit value ratios at an industry level can then be used to compute unit value ratios at a branch level of manufacturing production. Equation six and equation seven demonstrate how this is achieved by weighting industry unit value ratios with gross value added for that industry.[9] All industry unit value ratios are included in the formation of branch unit value ratios, regardless of their coverage ratio or share of total output.

(6) $$UVR_k^{XU(X)} = \frac{\sum_{i=1}^{b_k} GVA_i^{X(X)}}{\sum_{i=1}^{b_k} \frac{GVA_i^{X(X)}}{UVR_i^{XU(X)}}}$$

(7) $$UVR_k^{XU(U)} = \frac{\sum_{i=1}^{b_k} \left[GVA_i^{U(U)} * UVR_i^{XU(U)} \right]}{\sum_{i=1}^{b_k} GVA_i^{U(U)}}$$

Where

$UVR_k^{XU(X)}$ = Branch unit value ratio for country X using X as a base country

$UVR_k^{XU(U)}$ = Branch unit value ratio for country X using U as a base country

$GVA_i^{U(U)}$ = Gross value added share weights of country U for industry i

$GVA_i^{X(X)}$ = Gross value added share weights of country X for industry i

The final aggregation procedure for creating total manufacturing unit value ratios involves weighting branch unit value ratios by branch gross value added. This process is represented algebraically in equation eight and equation nine.

(8) $$UVR_t^{XU(X)} = \frac{\sum_{i=1}^{bt} GVA_k^{X(X)}}{\sum_{i=1}^{bt} \frac{GVA_k^{X(X)}}{UVR_k^{XU(X)}}}$$

See Van Ark (1993:14) and Szirmai, Shepherd, Prasada Rao and De Jong (1995:52).

[9] See Van Ark (1993:46) for sensitivity tests on unit value ratios at a branch level.

$$(9) \qquad UVR_t^{XU(U)} = \frac{\sum_{i=1}^{bt}\left[GVA_k^{U(U)} * UVR_k^{XU(U)}\right]}{\sum_{i=1}^{b_t} GVA_k^{U(U)}}$$

Where

$UVR_t^{XU(X)}$ = Total Manufacturing unit value ratio for country X using X as a base country

$UVR_t^{XU(U)}$ = Total Manufacturing unit value ratio for country X using U as a base country

$GVA_k^{U(U)}$ = Gross value added share weights of country U for branch k

$GVA_k^{X(X)}$ = Gross value added share weights of country X for branch k

The resulting unit value ratios at the industry, branch and total manufacturing level of production may then be used to deflate gross value added per person employed or hour worked to a common currency. While the ICOP literature acknowledges it is theoretically inconsistent to use gross output unit value ratios to deflate gross value added, the absence of price and quantity information for inputs prevent a construction of unit value ratios for both inputs and output. Therefore, input unit value ratios are assumed to equal output unit value ratios when deflating value-added to a common currency (De Jong 1994:9).

While the above procedure allows for the creation of industry, branch and total manufacturing unit value ratios for a specific year, (or what is referred to in the ICOP literature as a benchmark year) it is far more useful to view trends in labour productivity levels over a period of time. This is achieved using either one of two methods. The first method extrapolates labour productivity levels from a benchmark year using ratios of gross value added employment time series, as shown by equations 10 and 11 below.

(10)
$$\frac{\frac{GVA_{t+1}^{X(U)}}{EMP_{t+1}^{X(U)}}}{\frac{GVA_{t+1}^{U(U)}}{EMP_{t+1}^{U(U)}}} = \frac{\frac{GVA_t^{X(U)}}{EMP_t^{X(U)}} * \frac{GVA_{t+1}^{X(X)}}{EMP_{t+1}^{X(X)}} \Big/ \frac{GVA_t^{X(X)}}{EMP_t^{X(X)}}}{\frac{GVA_t^{U(U)}}{EMP_t^{U(U)}} * \frac{GVA_{t+1}^{U(U)}}{EMP_{t+1}^{U(U)}} \Big/ \frac{GVA_t^{U(U)}}{EMP_t^{U(U)}}}$$

(11)
$$\frac{\frac{GVA_{t+1}^{X(X)}}{EMP_{t+1}^{X(X)}}}{\frac{GVA_{t+1}^{U(X)}}{EMP_{t+1}^{U(X)}}} = \frac{\frac{GVA_t^{X(X)}}{EMP_t^{X(X)}} * \frac{GVA_{t+1}^{X(X)}}{EMP_{t+1}^{X(X)}} \Big/ \frac{GVA_t^{X(X)}}{EMP_t^{X(X)}}}{\frac{GVA_t^{U(X)}}{EMP_t^{U(X)}} * \frac{GVA_{t+1}^{U(U)}}{EMP_{t+1}^{U(U)}} \Big/ \frac{GVA_t^{U(U)}}{EMP_t^{U(U)}}}$$

Where

$\frac{GVA_{t+1}^{X(X)}}{EMP_{t+1}^{X(X)}}$ = Gross value added per person employed for country X in country X

prices for non-benchmark year t + 1

$\frac{GVA_t^{X(X)}}{EMP_t^{X(X)}}$ = Gross value added per person employed for country X in country X

prices for benchmark year t

$\frac{GVA_t^{U(U)}}{EMP_t^{U(U)}}$ = Gross value added per person employed for country U in country U

prices for benchmark year t

$\frac{GVA_{t+1}^{U(U)}}{EMP_{t+1}^{U(U)}}$ = Gross value added per person employed for country U in country U

prices for non-benchmark year t + 1

$\frac{GVA_t^{U(X)}}{EMP_t^{U(X)}}$ = Gross value added per person employed for country U in country X

prices for benchmark year t

$\frac{GVA_{t+1}^{U(X)}}{EMP_{t+1}^{U(X)}}$ = Gross value added per person employed for country U in country X

prices for non-benchmark year t + 1

$\frac{GVA_{t}^{X(U)}}{EMP_{t}^{X(U)}}$ = Gross value added per person employed for country X in country U

prices for benchmark year t

$\frac{GVA_{t+1}^{X(U)}}{EMP_{t+1}^{X(U)}}$ = Gross value added per person employed for country X in country U

prices for benchmark year t + 1

For extrapolations of gross value added per hour worked, ratios of gross value added and number of hours multiplied by employment numbers are used, as shown by equations 12 and 13 below.[10]

(12)
$$\frac{\frac{GVA_{t+1}^{X(X)}}{HRWKD_{t+1}^{X(X)}}}{\frac{GVA_{t+1}^{U(X)}}{HRWKD_{t+1}^{U(X)}}} = \frac{\frac{GVA_{t}^{X(X)}}{HRWKD_{t}^{X(X)}} * \frac{GVA_{t+1}^{X(X)}}{HRWKD_{t+1}^{X(X)}} \Big/ \frac{GVA_{t}^{X(X)}}{HRWKD_{t}^{X(X)}}}{\frac{GVA_{t}^{U(X)}}{HRWKD_{t}^{U(X)}} * \frac{GVA_{t+1}^{U(U)}}{HRWKD_{t+1}^{U(U)}} \Big/ \frac{GVA_{t}^{U(U)}}{HRWKD_{t}^{U(U)}}}$$

(13)
$$\frac{\frac{GVA_{t+1}^{X(U)}}{HRWKD_{t+1}^{X(U)}}}{\frac{GVA_{t+1}^{U(U)}}{HRWKD_{t+1}^{U(U)}}} = \frac{\frac{GVA_{t}^{X(U)}}{HRWKD_{t}^{X(U)}} * \frac{GVA_{t+1}^{X(X)}}{HRWKD_{t+1}^{X(X)}} \Big/ \frac{GVA_{t}^{X(X)}}{HRWKD_{t}^{X(X)}}}{\frac{GVA_{t}^{U(U)}}{HRWKD_{t}^{U(U)}} * \frac{GVA_{t+1}^{U(U)}}{HRWKD_{t+1}^{U(U)}} \Big/ \frac{GVA_{t}^{U(U)}}{HRWKD_{t}^{U(U)}}}$$

Where

[10] The methodology for both extrapolations was obtained from Van Ark (1993:69), though with adjustments made for the number of persons employed and hours worked.

$\frac{GVA_{t+1}^{X(X)}}{HRWKD_{t+1}^{X(X)}}$ = Gross value added per hour worked for country X in country X

prices for non-benchmark year t + 1

$\frac{GVA_{t}^{X(X)}}{HRWKD_{t}^{X(X)}}$ = Gross value added per hour worked for country X in country X

prices for benchmark year t

$\frac{GVA_{t}^{U(U)}}{HRWKD_{t}^{U(U)}}$ = Gross value added per hour worked for country U in country U

prices for benchmark year t

$\frac{GVA_{t+1}^{U(U)}}{HRWKD_{t+1}^{U(U)}}$ = Gross value added per hour worked for country U in country U

prices for non-benchmark year t + 1

$\frac{GVA_{t}^{U(X)}}{HRWKD_{t}^{U(X)}}$ = Gross value added per hour worked for country U in country X

prices for benchmark year t

$\frac{GVA_{t+1}^{U(X)}}{HRWKD_{t+1}^{U(X)}}$ = Gross value added per hour worked for country U in country X

prices for non-benchmark year t + 1

$\frac{GVA_{t}^{X(U)}}{HRWKD_{t}^{X(U)}}$ = Gross value added per hour worked for country X in country U

prices for benchmark year t

$\frac{GVA_{t+1}^{X(U)}}{HRWKD_{t+1}^{X(U)}}$ = Gross value added per hour worked for country X in country U

prices for benchmark year t + 1

The second methodology extrapolates unit value ratios from the benchmark year using manufacturing price indices, as shown in equations 14 and 15. The extrapolated unit value ratios may then be used to reflect both relative price levels (once divided by market exchange rates), and deflate gross value added per person employed or hour worked for a non-benchmark year. The extrapolation method, also

listed in Van Ark (1993:70), is applied at a branch and total manufacturing level of production to the benchmark unit value ratio.[11]

$$UVR_{t+1}^{XU(X)} = UVR_{t}^{XU(X)} * \frac{[P_{t+1}^{X(X)} / P_{t}^{X(X)}]}{[P_{t+1}^{U(U)} / P_{t}^{U(U)}]} \quad (14)$$

$$UVR_{t+1}^{XU(U)} = UVR_{t}^{XU(U)} * \frac{[P_{t+1}^{X(X)} / P_{t}^{X(X)}]}{[P_{t+1}^{U(U)} / P_{t}^{U(U)}]} \quad (15)$$

Where

$UVR_{t+1}^{XU(X)}$ = Unit value ratio for country X or U using country X quantities for non-benchmark year t + 1

$UVR_{t+1}^{XU(U)}$ = Unit value ratio for country X or U using country U quantities for non-benchmark year t + 1

$P_{t+1}^{X(X)}$ = Manufacturing price index for country X using country X quantities for non-benchmark year t + 1

$P_{t+1}^{U(U)}$ = Manufacturing price index for country U using country U quantities for non-benchmark year t + 1

$P_{t}^{X(X)}$ = Manufacturing price index for country X using country X quantities for benchmark year t

$P_{t}^{U(U)}$ = Manufacturing price index for country U using country U quantities for benchmark year t

While the two methods outlined above eliminate the need to calculate unit value ratios on an annual basis, extrapolations over long time periods may result in inconsistencies between benchmark unit value ratios and extrapolated results. This can occur due to differences in the rate of structural change between countries, changing prices and the structure of production censuses over time, as well as

[11] Extrapolations of unit value ratios at an industry level usually cannot be obtained due to an absence of manufacturing price indices at this level.

differences in methods used to calculate time series. Therefore, attempts should be made to update benchmark unit value ratios on a regular basis (Van Ark 1993:83).

2.3.2 Deficiencies of the Industry-of-Origin Approach

The accuracy of the industry-of-origin approach relies heavily on the consistency of product matches between a pair of countries. The ICOP literature concentrates on three factors that may compromise this process. First, the quality of products may not be consistent between countries. This is the reason why most of the product matches in ICOP studies are restricted to homogenous products such as cement, food, beer, paper, wood and mineral products (Van Ark 1993:34).[12] Second, unique products and confidentiality rules tend to preclude a product match in many cases (Van Ark and Pilat 1993:7). Third, a production census is not always available for consistent years between countries.[13] As such, the benchmark year in ICOP studies is almost always in 1975 or 1987, as most countries conducted a production census during these years.

Notably, using a production census as a source of information causes each of the three problems. Despite these flaws, the ICOP literature stresses that, when available, a census of production should always be used as a primary information source for industry-of-origin studies. This is because the census lists product information in far greater detail than other information sources, such as the national accounts and the *UNIDO Yearbook of Industrial Statistics*. Census data are also favoured by ICOP studies as some countries include gross value added and employment data with the product information, thereby ensuring data consistency (Van Ark and Maddison 1994:9).

[12] According to Van Ark (1996a:14), product matches for heterogenous products such as consumer and investment goods rarely exceed 10 per cent of total output.
[13] Refer to Van Ark and Maddison (1994:36-9) for the method to adjust for using production censuses conducted in different years.

2.3.3 Australian Industry-of-Origin Studies

Australian industry-of-origin studies have been confined to those undertaken by the COPPAA project at the University of Griffith. Three binary comparisons within this region have been conducted, with the manufacturing sector being the focus of each study. Pilat, Prasada Rao and Shepherd (1993) compared Australia with the United States between 1970 and 1989, using 1987 as a benchmark year. Their results showed that Australian manufacturing labour productivity levels were half that of the United States levels over this period, with higher levels found for industries exposed to the international market. This implied that Australian labour productivity levels in the manufacturing sector were 50 per cent below best practice, given the United States leads the world in labour productivity.[14]

The second COPPAA study, conducted by Szirmai, Shepherd, Prasada Rao and De Jong (1995), examined gross output, labour productivity and price levels between Indonesia and Australia. The benchmark year chosen for the analysis was 1987, with backward and forward extrapolations made between 1975 and 1990. Szirmai *et al.* (1995:39) found Indonesian labour productivity levels averaged only 15 per cent of the Australian levels over the period examined, suggesting that the both countries had a complementary economic structure. However, the authors noted that a rapid catch-up of labour productivity in simply and elaborately transformed manufactures was reducing this complementarity and that Australian policy makers should be wary of such a trend.

Shepherd and Prasada Rao (1997) conducted the third COPPAA paper to date that involves Australia as a comparator country. Korean gross output, labour productivity and price levels were compared with Australia from 1975 to 1994, with 1987 again used as a benchmark year. High labour productivity growth in Korea relative to

[14] This was found to be the case by Van Ark and Pilat (1993:38), although Japan was discovered as the world labour productivity leader in the machinery and transport equipment branches.

Australia was found to have led to an increase in labour productivity from 49.6 per cent to 111.8 per cent of the Australian level over the period considered.

The main deficiency identified by the review of Australian industry-of-origin studies is that the COPPAA project has yet to compare other Asian-Pacific countries, such as Taiwan, with the Australian manufacturing sector. This is primarily due to the fact that the COPPAA project is still in the early stages, as evidenced by the small number of labour productivity studies.

2.4 Conclusion

A review of the RCA literature found that despite the various criticisms of this methodology by some authors, in particular the distortions created by trade policies, the evidence suggests they are an appropriate tool for measuring comparative advantage. The review of the industry-of-origin methodology showed that there were some drawbacks associated with its use, particularly due to the prevalence of confidentiality rules, unique products and inconsistent quality, although it was shown to be preferable to the use of market exchange rates. The literature review also exposed the lack of bilateral RCA and industry-of-origin studies for Australia. This demonstrates a deficiency in the RCA and industry-of-origin literature that the present study seeks to address.

- CHAPTER THREE -

ROLE OF MANUFACTURING AND FOREIGN TRADE IN TAIWAN AND AUSTRALIA

3.1 Introduction

Prior to examining comparative advantage between Taiwan and Australia, it is necessary to discuss the importance of manufacturing and foreign trade to both countries. This chapter will begin with an overview of the role played by manufacturing in Gross Domestic Product (GDP), employment, exports and imports for each country. The importance of the bilateral trading relationship between Australia and Taiwan and the composition of this trade will then be discussed. This will be followed by a discussion of the trade policies adopted by both countries before summarising and concluding the main points raised in this chapter.

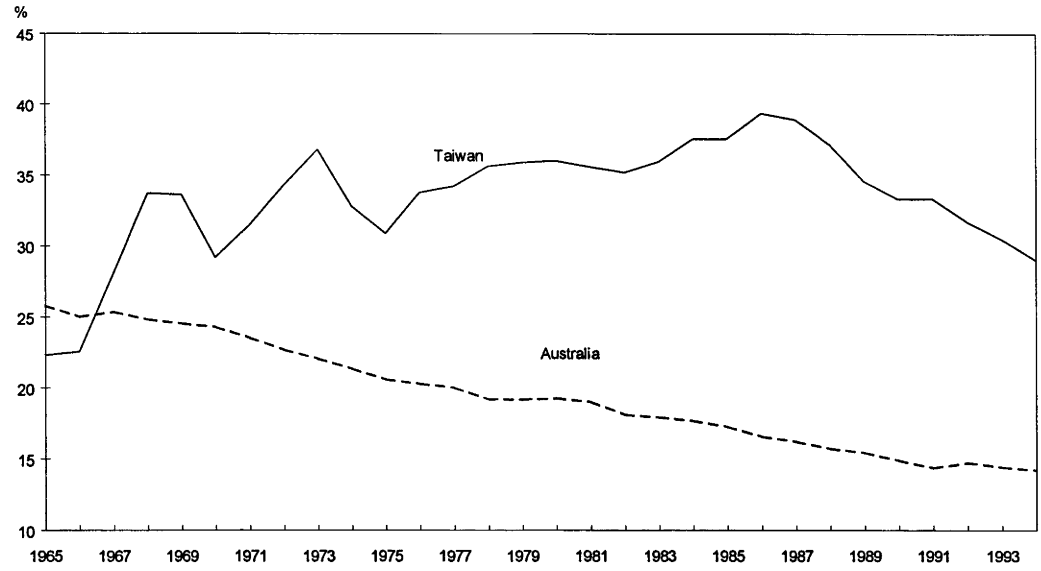
3.2 Contribution of Manufacturing to Economic Development in Australia and Taiwan

3.2.1 Share of Manufacturing in Gross Domestic Product

According to figure 3.1, manufacturing made a far greater contribution to the GDP of Taiwan than Australia. While the share of manufacturing in GDP (in current prices) was approximately equal in 1965 for both countries, Taiwan's share rose steadily up until 1986 where it peaked at 39 per cent. Thereafter, the manufacturing GDP share gradually declined to 31 per cent in 1994. For the Australian manufacturing GDP share, a continuous decline was observed between 1965 to 1994, falling from 25 per cent to 14 per cent respectively.[1]

[1] It should be noted that the manufacturing share in GDP continued to increase up until the late 1950s, where it peaked at 29 per cent (Anderson 1987:166).

Figure 3.1 Share of Manufacturing in GDP for Australia and Taiwan, 1965-94
(Current Prices)



Source: For Australia, Foster, R.A. (1996), *Australian Economic Statistics 1949-50 to 1994-95*, Occasional Paper, Sydney: Reserve Bank of Australia; and for Taiwan, Council for Economic Planning and Development (1997), *Taiwan Statistical Data Book 1996*, Taipei: Council for Economic Cooperation and Development.

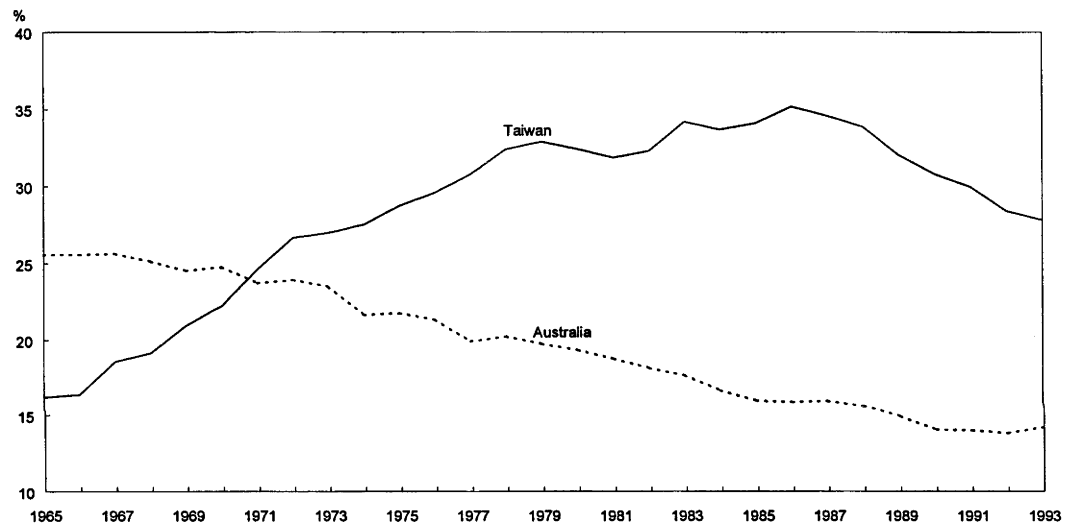
The declining manufacturing GDP share in Taiwan and Australia can be attributed to a number of factors. For Taiwan, an appreciating New Taiwan (NT) dollar against the United States, domestic wage growth, as well as a shift in consumer demand to services, were important in explaining the falling GDP share after 1986. The appreciating NT dollar was particularly significant, given the high outward orientation of Taiwan's manufacturing sector (Schive 1995:14). In Australia, changes in trade policy were the main factor driving falls in the manufacturing GDP share (Bora and Pomfret 1995:91). The resources boom and equalisation of male and female real wages during the 1970s, as well as financial deregulation in the 1980s, have also been considered important in explaining the falling GDP share for manufacturing (Anderson 1987:172-4, Clark, Geer and Underhill 1996:22).[2] However, it is possible that calculating the manufacturing GDP share in terms of current prices exacerbated the apparent fall. This is because falls in current prices tend to accompany rises in productivity growth (Clark, Geer and Underhill 1996:23).

[2] Bora and Pomfret (1995:94-5) considered these factors as more important in explaining the rising share of mining and services in GDP, thereby causing a corresponding decline in the relative manufacturing GDP share.

3.2.2 Share of Manufacturing in Employment

Manufacturing was also more important for Taiwan than Australia in terms of its contribution to employment. In figure 3.2, the manufacturing share of employment continually rose between 1965 and 1986 from 16 per cent to 35 per cent respectively, but gradually fell thereafter to 27 per cent in 1993. The Australian share, which Taiwan had surpassed in 1971, fell continuously from 25 per cent to 14 per cent respectively between 1965 and 1993.[3]

Figure 3.2 Share of Labour Force Employed in Manufacturing - Taiwan and Australia, 1965-93



Source: For Australia, Foster, R.A. (1996), *Australian Economic Statistics 1949-50 to 1994-95*, Occasional Paper, Sydney: Reserve Bank of Australia; and for Taiwan, Council for Economic Planning and Development (1997), *Taiwan Statistical Data Book 1996*, Taipei: Council for Economic Cooperation and Development.

The reasons for the declining shares of manufacturing in total employment for both countries were similar to those outlined above. In Taiwan, rising domestic wages increased the use of automated machinery to offset declining competitiveness (Schive 1995:15). For Australia, several factors were at play. Tariff cuts, a mineral boom-induced currency appreciation, increased labour force size, economic recessions and an expansion of the service sector, all acted to reduce the manufacturing share of

[3] The share of manufacturing in total employment had peaked around 1950 (Anderson 1987:166).

employment (Krause 1984:290, Clark, Geer and Underhill 1995:19, table 3.1, figure 3.3).

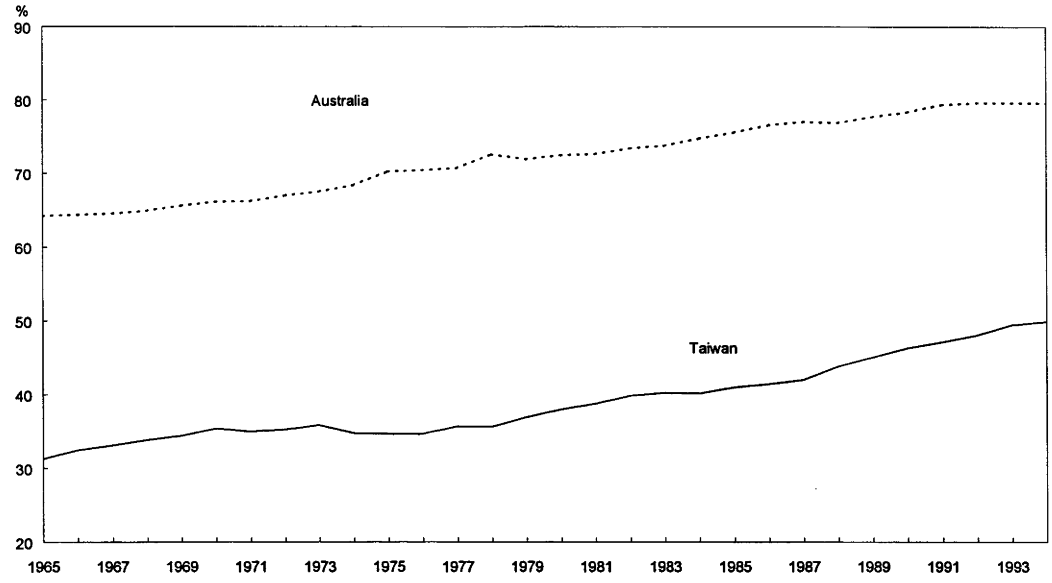
Table 3.1 Number of Persons Employed in Manufacturing and Labour Force for Australia, 1965-94

Year	Manufacturing Employment ('000)	Total Employment ('000)
1965	..	4628
1966	1233	4839
1967	1261	4928
1968	1264	5046
1969	1302	5188
1970	1320	5387
1971	1365	5516
1972	1331	5610
1973	1382	5783
1974	1374	5855
1975	1263	5841
1976	1281	5898
1977	1277	5995
1978	1220	6005
1979	1229	6079
1980	1240	6281
1981	1236	6394
1982	1196	6379
1983	1132	6241
1984	1142	6466
1985	1113	6676
1986	1132	6919
1987	1154	7092
1988	1204	7353
1989	1236	7728
1990	1200	7825
1991	1107	7669
1992	1088	7637
1993	1079	7680
1994	1111	7921

Note: .. Not Available

Sources: Australian Bureau of Statistics (ABS), *Labour Force Historical Summary 1966 to 1984*, (ABS Cat. No. 6101.0), Canberra: AGPS; ABS, *Labour Force Australia*, (ABS Cat. No. 6203.0), Canberra: AGPS.

Figure 3.3 Share of Services in Employment for Taiwan and Australia, 1965-94



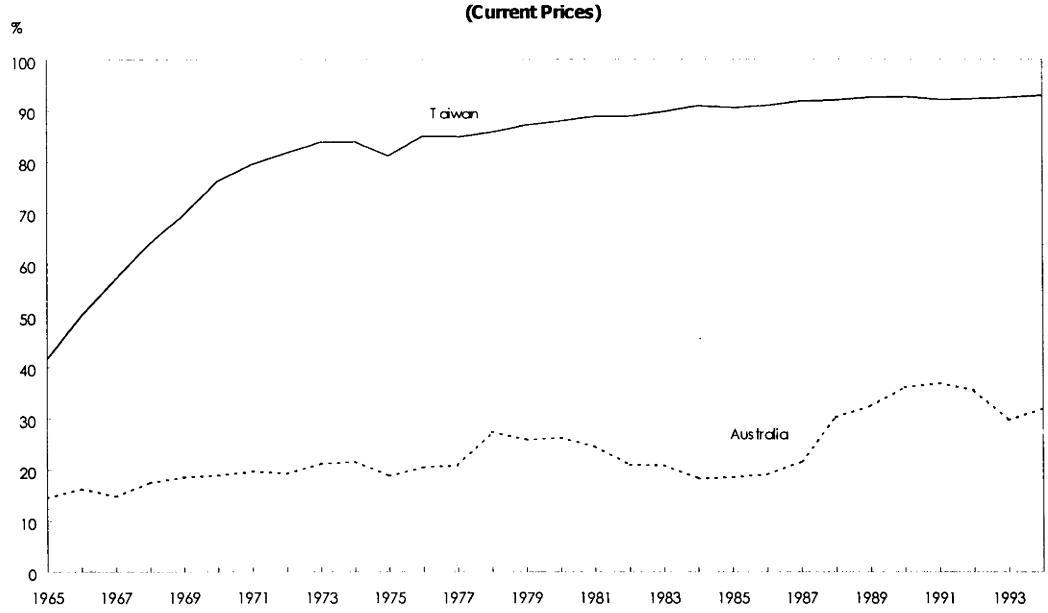
Source: For Australia, Foster, R.A. (1996), *Australian Economic Statistics 1949-50 to 1994-95*, Occasional Paper, Sydney: Reserve Bank of Australia; and for Taiwan, Council for Economic Planning and Development (1997), *Taiwan Statistical Data Book 1996*, Taipei: Council for Economic Cooperation and Development.

3.2.3 Share of Manufacturing in Total Exports

The importance of manufacturing to the Taiwanese economy was no more evident than from the total export share. The manufacturing share of exports increased from 41 per cent to 93 per cent respectively between 1965 and 1995, as figure 3.4 shows. The share was revealed as having levelled off after the mid-1980s. For Australia, the contribution of manufacturing to total exports was far lower, increasing from 14 per cent to 33 per cent between 1965 and 1995. Clearly, most of the increase took place after 1986.[4]

[4] Manufactured exports are defined as SITC 5 - 8 less 68, where SITC 5 = chemicals, SITC 6 = manufactured goods classified chiefly by material, SITC 7 = transport and machinery equipment and SITC 8 = miscellaneous manufactures less SITC 68 = non-ferrous metals.

Figure 3.4 Share of Manufactures In Total Exports, 1965-94
(Current Prices)



Source: UN Trade Data, International Economic Databank, Australian National University.

Several factors can explain trends in the manufacturing share of exports for Taiwan. The dearth of natural resources and small domestic market size meant that Taiwan could not achieve economic development without exporting manufactured goods.[5] The appreciating New Taiwan dollar may have been the main factor behind the stagnation in manufactured export share, which caused many Taiwan producers to shift plant production to Asian neighbours (Schive 1995:14). Growth in Australian manufacturing exports after the mid-1980s reflected several factors. For Sheehan, Pappas and Cheng (1994:*ix*) the sharp 1985/86 currency depreciation, subdued domestic wage growth, greater export awareness by Australian firms and government export policies were the main factors. Drysdale and Lu (1996:31) considered rapid growth in import demand by East Asia and falling Australian tariff levels as playing a relatively more important role.

[5] According to Ranis (1979:240-1), Taiwan's two main industries, textiles and electronics, did not develop until the Taiwanese government in 1958 adopted an external focus.

Table 3.2: Taiwan's Principle Manufactured Export Shares (%), 1965-94

Commodity	Factor Intensity	1965	1974	1984	1994
Veneers and Plywood	NR	15.1	3.9	1.1	0.2
Textile Yarn and Thread	UL	11.0	4.1	2.6	2.0
Non-Fur Clothing	UL	10.7	19.3	13.6	4.2
Woven Cotton Fabrics	UL	10.4	3.4	0.9	0.6
Articles of Plastic	UL	4.8	3.0	2.9	2.4
Cement Building Products	NR	4.7	0.4	0.6	0.1
Essential Oil and Perfume	HC	3.7	0.3	0.0	0.0
Telecommunications Equipment	T	3.1	14.5	9.4	4.3
Organic Chemicals	T	2.5	0.7	0.5	0.7
Primary Forms of Iron and Steel	HC	2.4	0.0	0.1	0.3
Plastic Materials	UL	1.6	0.7	1.3	3.4
Toys and Sporting Goods	UL	1.4	4.6	7.1	3.8
Footwear	UL	1.3	6.0	7.9	1.3
Non-Cotton Woven Textiles	UL	1.2	4.7	2.9	4.8
Electrical Machinery n.e.s.	T	0.9	4.0	4.5	10.5
Non-Electric Machines	T	0.4	1.3	1.9	4.4
Electric Power Machinery	T	0.4	1.0	2.4	4.8
Travel Goods and Handbags	UL	0.2	1.6	3.1	0.7
Furniture	UL	0.1	1.0	2.6	2.6
Office Machines	T	0.0	1.9	3.7	17.6

Note: defined as a share of total manufactured exports; T = Technology-Intensive, NR = Natural Resource-Intensive, HC = Human Capital-Intensive, UL = Unskilled Labour-Intensive.
Source: UN trade data, International Economic Databank, Australian National University.

3.2.4 Composition of Manufactures in Total Exports

Table 3.2 reveals the composition of Taiwan's manufactured export share between 1965 and 1994. In 1965, natural resource-intensive and unskilled labour-intensive manufactures such as veneers and plywood, textile yarn and thread, non-fur clothing and woven cotton fabrics dominated the export share, holding between 15 per cent and 10 per cent of total manufactured exports. By 1974, non-fur clothing and telecommunications equipment had become Taiwan's main exports, accounting for 19 per cent and 15 per cent of manufactured exports respectively. These exports continued to hold the highest shares in 1984, despite falling to 14 and nine per cent respectively. Unskilled labour-intensive manufactures such as toys and sporting goods and footwear maintained relatively high shares in this year. By 1994, 18 per

cent and 11 per cent respectively of total manufactured exports were held by the technology-intensive office machinery and electrical machinery, with all unskilled labour-intensive goods except for plastic materials, non-cotton woven textiles and furniture recording a fall in their export share.

Table 3.3: Australia's Principle Manufactured Export Shares (%), 1965-94

Commodity	Factor Intensity	1965	1974	1984	1994
Motor Vehicles	HC	13.1	10.4	5.6	5.2
Iron and Steel Plates and Sheets	HC	8.2	3.6	4.3	2.4
Non-Electric Machines	T	4.3	4.4	3.7	6.4
Machines for Special Industries	T	3.6	2.2	1.4	1.7
Medical Products	T	3.5	1.9	2.5	3.7
Chemicals	T	3.5	2.2	2.0	2.2
Organic Chemicals	T	3.1	1.0	0.8	0.5
Agricultural Machinery	T	3.1	2.5	1.1	0.5
Iron and Steel Shapes	HC	2.7	1.9	0.5	0.9
Iron and Steel Tubes and Pipes	HC	2.5	1.7	0.7	0.5
Pearls, Precious- and Semi-Precious Stones	NR	2.4	1.5	1.7	2.9
Instruments and Apparatus	T	2.1	1.8	2.7	2.0
Non-Electric Power Machinery	T	2.0	1.5	3.2	2.6
Telecommunications Equipment	T	1.7	0.8	0.7	3.6
Plastic Materials	T	1.6	1.6	3.1	1.6
Inorganic Elements	NR	0.8	17.4	30.5	14.3
Pig Iron	NR	0.7	4.3	0.6	0.5
Ships and Boats	UL	0.7	2.3	0.5	1.5
Photo and Cinema Supplies	T	0.7	0.7	2.6	1.6
Office Machinery	T	0.6	0.8	1.1	5.4
Primary Forms of Iron and Steel	HC	0.2	5.6	2.1	4.4
Veneers and Plywood	NR	0.2	3.1	5.2	3.0

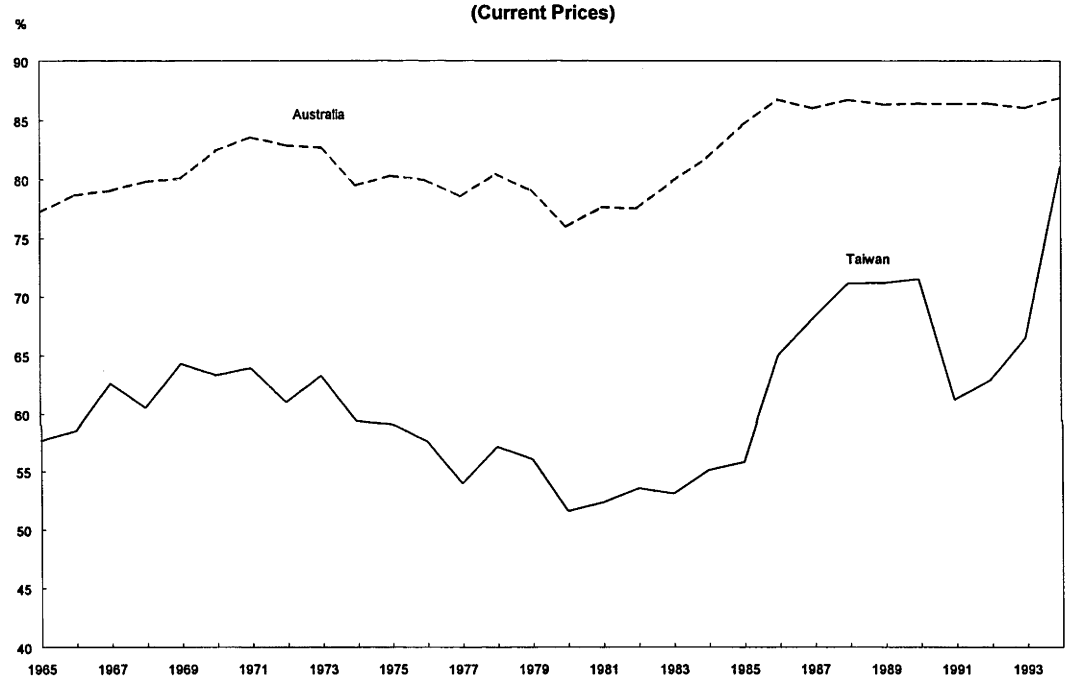
Note: defined as a share of total manufactured exports; T = Technology-Intensive, NR = Natural Resource-Intensive, HC = Human Capital-Intensive, UL = Unskilled Labour-Intensive.

Source: UN trade data, International Economic Databank, Australian National University.

Table 3.3 reveals the principle manufactured export shares for Australia between 1965 and 1994. In 1965, the human capital-intensive motor vehicles and iron and steel industries held the highest manufactured export shares, with 13 per cent and eight per cent respectively of total manufactured exports. By 1974, natural resource-

intensive inorganic elements had become Australia's main manufactured export, rising to 17 per cent from less than one per cent in 1965, although motor vehicles continued to hold a relatively high share at 10 per cent.[6] Inorganic chemicals dominated the manufactured export share in 1984, holding nearly 31 per cent. This category continued to hold the largest share in 1994, although it had fallen substantially to 14 per cent of total manufactured exports. Nonetheless, this far exceeded the export shares of other industries, with the second highest share being from the technology-intensive non-electric machinery at six per cent.

Figure 3.5 Share of Manufactures in Total Imports, 1965-94
(Current Prices)



Source: UN trade data, International Economic Databank, Australian National University.

[6] An examination of the inorganic chemical category at a four-digit level revealed aluminium oxides to hold the highest share, which are a by-product of Australia's world class mining industry.

3.2.5 Share of Manufactures in Total Imports

Australia was shown to have a far greater share of manufactures in total imports than Taiwan for most of the period between 1965 and 1994. Figure 3.5 shows that Australia's import composition was consistently dominated by manufactures, increasing from 77 per cent to 86 per cent of total imports respectively from 1965 to 1994.[7] The share of manufactures in total imports remained relatively constant between 1965 until 1981, sharply increasing between 1982 and 1986, before levelling out at around 88 per cent until 1994. For Taiwan, the share gradually declined between 1965 and 1985, increased up to the late-1980s and remained relatively stable until a sharp rise in 1994 to 82 per cent of total imports.

The relatively high share of manufactures in total imports can be explained by several factors. The development of Taiwan's export industries in the early- to mid-1960s was assisted by adding value to intermediate input and capital equipment imports (Scott 1979:321, Ranis 1979:241). The recent rise in Taiwan's manufactured import share is likely to have been fuelled by an appreciation of the domestic currency (Wu 1989:2, De La Cuesta 1995:230). The high share of manufactures in Australian imports is explained by the fact that Australia has traditionally had a strong demand for manufactured imports financed by exchanging primary exports (Pomfret 1996:4).

[7] According to Pomfret (1996:4), Australia's import composition has always been dominated by manufactures.

3.2.6 Composition of Manufactures in Total Imports

Table 3.4: Taiwan's Principle Manufactured Import Shares (%), 1965-94

Commodity	Factor Intensity	1965	1974	1984	1994
Non-Electric Power Machinery	T	10.9	2.4	1.2	1.1
Iron and Steel Plates and Sheets	HC	8.3	7.6	2.3	1.9
Iron and Steel Plates and Sheets	HC	8.3	7.6	2.3	1.9
Textile and Leather Machinery	T	7.6	12.6	3.9	1.3
Road Motor Vehicles	HC	6.7	3.9	3.4	6.9
Ships and Boats	UL	6.3	6.2	5.1	0.6
Non-Electric Machines	T	4.6	8.3	7.4	8.0
Chemicals	T	4.4	1.7	2.7	2.1
Manufactured Fertilizers	T	4.4	1.0	0.1	0.1
Telecommunications Equipment	T	4.3	0.0	2.4	1.7
Plastic Materials	UL	3.2	3.9	3.1	3.1
Textile Yarn and Thread	UL	3.1	2.0	1.0	1.1
Electric Power Machinery	T	2.5	5.3	6.0	4.0
Instruments and Apparatus	T	2.2	1.3	2.0	3.8
Electrical Machinery	T	2.1	5.5	13.9	19.7
Organic Chemicals	T	1.3	7.4	8.4	7.1
Iron and Steel Primary Forms	HC	0.9	0.4	1.4	3.8
Aircraft	T	0.7	0.6	0.1	1.7
Office Machinery	T	0.4	1.3	3.3	3.1
Other Manufactured Goods	UL	0.0	0.2	4.3	0.3

Note: as a share of total manufactured imports; T = Technology-Intensive, NR = Natural Resource-Intensive, HC = Human Capital-Intensive, UL = Unskilled Labour-Intensive.
Source: UN trade data, International Economic Databank, Australian National University.

Table 3.4 shows the composition of Taiwan's principle manufactured imports between 1965 and 1994. In 1965, the manufactured import share was dominated by inputs required for developing Taiwan's export industry, such as non-electric power machinery (11 per cent), iron and steel plates and sheets (eight per cent) and textile and leather machinery (eight per cent). The increased specialisation in clothing exports in 1974, shown previously in table 3.2, led to a correlated rise in textile and leather machinery imports to 13 per cent.[8] Organic chemicals, non-electric and

[8] Scott (1979:353) noted the high import content of Taiwan's exports between 1973 and 1975.

electric machinery also became increasingly important in this year. By 1984, electrical machinery accounted for the highest share of manufactured imports as Taiwan's export structure became increasingly sophisticated. Imports of textile and leather machinery fell steeply to four per cent, as clothing exports became less important. Electrical machinery dominated Taiwan's manufactured import structure by 1994, accounting for nearly 20 per cent of total manufactured imports.

Table 3.5: Australia's Principle Manufactured Import Shares (Percentages), 1965-94

Commodity	Factor Intensity	1965	1974	1984	1994
Road Motor Vehicles	HC	13.1	12	12.5	13.4
Non-Electric Machines	T	5.7	6.8	7.3	8.0
Agricultural Machinery	T	4.6	1.5	2.2	1.1
Paper and Paper-Board	HC	3.8	3.5	3.0	2.4
Non-Electric Power Machinery	T	3.7	2.5	2.1	2.3
Aircraft	T	3.6	2.0	1.9	2.3
Machines for Special Industries	T	3.6	3.2	2.8	2.8
Office Machines	T	3.5	3.6	6.1	8.2
Woven Cotton Fabrics	UL	3.5	2.9	1.6	0.5
Organic Chemicals	T	3.4	3.7	3.2	2.8
Plastic Materials	T	2.7	3.6	2.7	2.3
Electrical Machinery	T	2.5	2.8	3.6	4.3
Electric Power Machinery	T	2.4	1.9	2.3	2.5
Telecommunications Equipment	T	1.9	2.5	3.4	4.3
Instruments and Apparatus	T	1.9	2.5	3.0	3.8
Medicinal Products	T	1.8	1.6	1.2	2.6
Printed Matter	HC	1.8	1.8	2.0	1.5
Non-Fur Clothing	UL	0.9	3.0	2.3	2.7
Sound Recorders	HC	0.7	1.6	2.6	2.3
Plastic Articles	UL	0.4	0.6	1.0	1.5

Note: as a share of total manufactured imports; T = Technology-Intensive, NR = Natural Resource-Intensive, HC = Human Capital-Intensive, UL = Unskilled Labour-Intensive.
Source: UN trade data, International Economic Databank, Australian National University.

The highest manufactured import shares for Australia are listed in table 3.5. Clearly road motor vehicles dominated manufactured imports between 1965 and 1994, averaging 13 per cent during these years. Non-electrical machinery was also shown to be an important import for Australia over this period, increasing from six per cent to eight per cent of total manufactured imports. A closer examination of

manufactured imports at a SITC four-digit level shows that pumps and centrifuges, mechanical handling equipment and machine parts and accessories held the largest import shares within the non-electrical machinery category. Other industries to record an increase in their share of manufactured imports between 1965 and 1994 were office machinery (four per cent to eight per cent), telecommunications equipment (two per cent to four per cent) and electrical machinery (three per cent to four per cent).

3.3 Contribution of Foreign Trade to Economic Development in Taiwan and Australia

To assess the importance of foreign trade to the Australian and Taiwanese economies, the trade intensity ratio, or the sum of exports and imports as a share of GDP, was used in table 3.6. Between 1965 and 1990, Taiwan was shown to have the highest trade dependence relative to the major industrialised economies, including Australia. Taiwan's trade intensity ratio increased from 81 per cent to 85 per cent respectively in 1974 and 1984, although a slight decline was recorded in 1990 to 76 per cent. In contrast, the trade intensity ratio increased only marginally in 1965 and 1974, from 31 per cent to 32 per cent and remained unchanged at 35 per cent in 1984 and 1990.[9] This was well below the average of other industrialised economies, though with the exception of the United States.

Table 3.6: Trade Intensity Ratio for Australia and Taiwan relative to other Major Industrialised Countries, 1965-90

COUNTRY	1965	1974	1984	1990
Taiwan	..	81	85	76
Australia	31	32	35	35
Canada	38	50	54	51
Germany	36	48	59	58
New Zealand	46	56	70	..
United States	10	17	19	21

Notes: .. Not available.

Sources: Penn World Tables, International Economic Databank, Australian National University; and Ergas, H. & Wright, M. (1994), 'Internationalisation, Firm Conduct and Productivity', in *International Integration of the Australian Economy*, eds. P. Lowe & J. Dwyer, Proceedings of a Conference held at the H.C. Coombs Centre for Financial Studies, Kirribilli on 11/12 July 1994, Table 2:58.

[9] According to Pomfret (1996:17), Australia's trade/GDP ratio was amongst the lowest in the OECD in 1984, compared to the highest in the world during the mid 1800s.

The results in table 3.6 are explained by several factors. Taiwan's small domestic market and natural resource base meant that economic development was not possible without trade (Riedel 1992:254, Scott 1979:350). The foreign exchange earned by exports financed raw material and capital equipment imports necessary for economic development (Kuo and Fei 1985:45). Taiwanese government policies to promote exports are also considered to have led to a higher than average trade intensity ratio (Rabushka 1987:136). Australia's high tariff barriers and natural protection factors, such as a rich natural resource endowment and distance from main markets, resulted in a relatively low trade/GDP ratio during the 1960s and 1970s.[10] The reduction in import barriers and a redirection of Australian trade towards the East Asian region along with an increased awareness of exporting by Australian businesses may therefore have been responsible for the slight increase in the trade intensity ratio between the 1980s and 1990s (Krause 1984:287, Lowe 1994:1).

An examination of import and export ranking's in table 3.7 indicates Taiwan became a more important trading partner for Australia between the 1970s and 1990s. Taiwan became Australia's seventh main import market in 1994, up from 13th position in 1971. In nominal terms, this was equivalent to a rise in import value from $A54 million to $A2.5 billion over the same period. This led to a rise in Taiwan's share of total Australian imports from 1.2 per cent in 1971 to 3.7 per cent in 1994, although this was down from a peak of 4.3 per cent in 1987.

[10] High tariff barriers directly lowered import volumes and discouraged exports by raising input costs and promoting an inward orientation by domestic firms.

Table 3.7: Importance of Taiwan as a Trading Partner to Australia, 1965-94

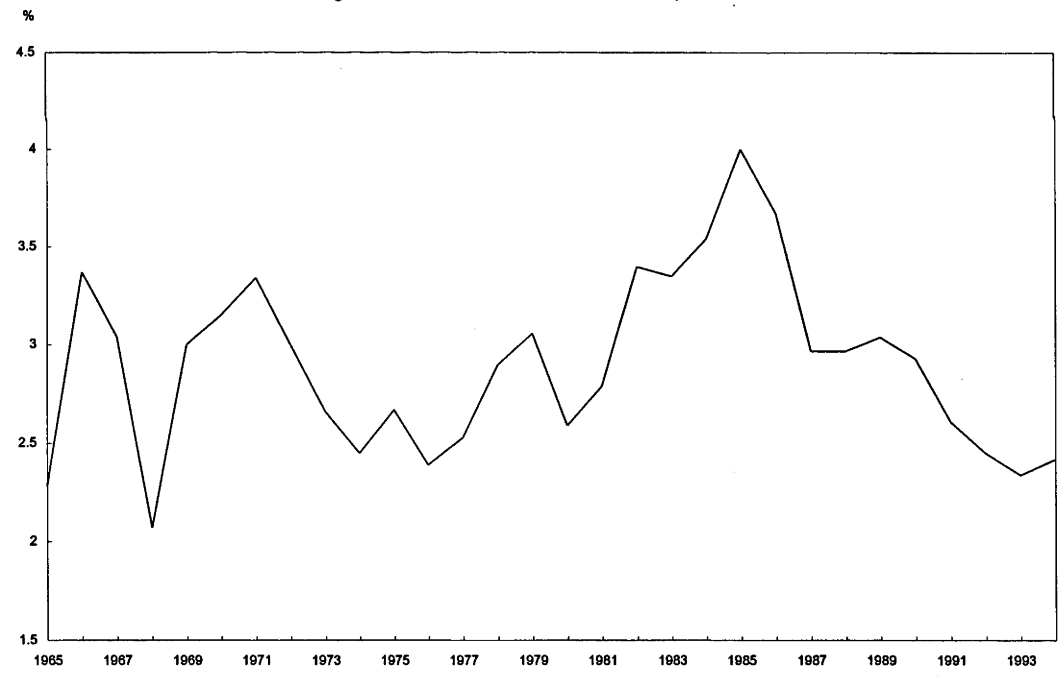
	Total Export Value ($A'000)	Total Import Value ($A'000)	Trade Balance	Share of Australia's Exports to Taiwan	Export Market Ranking	Share of Australia's Imports from Taiwan	Import Market Ranking
1965	16779	4692	15758	0.6	..	0.2	..
1966	19452	3729	20081	0.7	..	0.1	..
1967	18287	7003	15206	0.6	..	0.2	..
1968	21578	10120	15320	0.7	..	0.3	..
1969	28062	13823	19305	0.8	..	0.4	..
1970	34516	18365	21665	0.9	..	0.5	..
1971	44848	29959	21413	1	17	0.7	14
1972	60866	44542	26620	1.2	15	1.2	13
1973	68247	77939	-10217	1	18	1.6	10
1974	87036	141493	-94748	1.2	20	1.8	14
1975	98892	102505	1801	1.1	19	1.4	13
1976	116279	173646	-75087	1.1	19	1.9	11
1977	156039	237738	-84743	1.3	19	2.2	11
1978	230458	288720	-61123	1.9	11	2.4	9
1979	317925	384853	-65637	1.9	16	2.6	9
1980	344814	468076	-135454	1.8	14	2.7	7
1981	373515	571078	-234556	2	10	2.8	10
1982	464611	673736	-187805	2.2	8	2.9	7
1983	603696	699500	-55718	2.8	7	3.3	7
1984	709461	966890	-167227	2.8	7	3.7	6
1985	941784	1121706	-65808	3	7	3.4	6
1986	1082899	1324675	-84518	3.4	7	3.6	5
1987	1224146	1638781	-171458	3.5	7	4.3	5
1988	1465072	1784295	-162033	3.8	6	4.2	6
1989	1579923	2046782	-259907	3.8	6	4.1	6
1990	1678884	1762782	-21316	3.6	7	3.5	6
1991	2109472	1859120	182267	4.4	6	3.7	6
1992	2363422	2091006	176462	4.6	6	3.6	7
1993	2646730	2295442	215442	4.8	7	3.6	7
1994	2750673	2461576	227104	4.8	6	3.6	7

Sources: Export and import values from UN trade data, International Economic Databank, Australian National University; export and import ranking's from Dippelsman, R. (1989), Taiwan: The Spectacular Growth of the 'Other China", Canberra: Department of the Parliamentary Library; Department of Foreign Affairs and Trade (DFAT), (1994), Composition of Trade, Australia, Central Statistics Section, Canberra: DFAT.

3.4 Importance of the Trade Relationship between Australia and Taiwan

Taiwan's importance as an export market for Australia increased from 17th rank in 1971 to 6th highest rank in 1994, with export values rising from $A44.8 million to nearly $A2.8 billion. The rapid increase in export volumes enabled Australia to achieve a trade surplus with Taiwan for the first time in 1991 since 1975. However, this was not sufficient to sustain growth in market share (Australian exports as a percentage of Taiwan's total imports), despite the rise in the Australian export share to Taiwan from 1.2 per cent to 4.8 per cent over the same period. According to figure 3.6, market share rose from 2.4 per cent to 3.9 per cent between 1974 and 1985 respectively, but declined thereafter to 2.6 per cent in 1994. Figure 3.7 shows that most of the market share loss were attributed to agricultural and fuel, mineral and metal-based exports.[11] A rise in market share was recorded for Australian manufactured exports, although this was from a very low base.

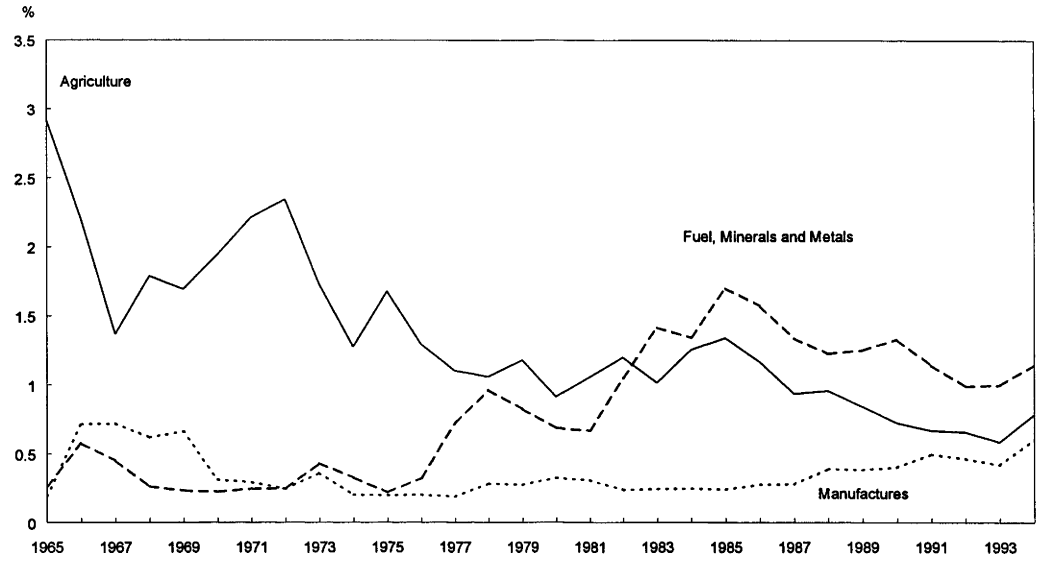
Figure 3.6 Australian Market Shares in Taiwan, 1965-1994



Source: UN trade data, International Economic Databank, Australian National University.

[11] Drysdale and Lu (1996:12) confirmed the loss of market share by Australian agricultural goods across East Asia.

Figure 3.7 Composition of Australia's Market Share in Taiwan, 1965-94



Source: UN trade data, International Economic Databank, Australian National University.

According to table 3.8, the increased importance of Taiwan as a trading partner for Australia was not reciprocated. Australia was Taiwan's sixth main source of imports in 1994, compared to fourth in 1990-91.[12] As a share of Taiwan's total imports, Australia accounted for nearly three per cent in 1994, whereas in 1985 the share was four per cent. In terms of Australia's importance as an export destination for Taiwan, a fall was also recorded, from fifth rank in 1981 to 11th highest position in 1994. This corresponded to a decline in the share of Taiwan's total exports to Australia, falling from three per cent to less than two per cent over the same period. Yet, as shown in figure 3.8, it was not until 1987 that Taiwan lost market share in Australia from four per cent to three per cent in 1994.[13]

[12] Australia was also Taiwan's fourth main import source in 1984, 1973, 1969 to 1971 and 1966.
[13] As Taiwan's exports to Australia consist almost entirely of manufactures, figure 3.9 represents Taiwan's market share in Australia for manufactures.

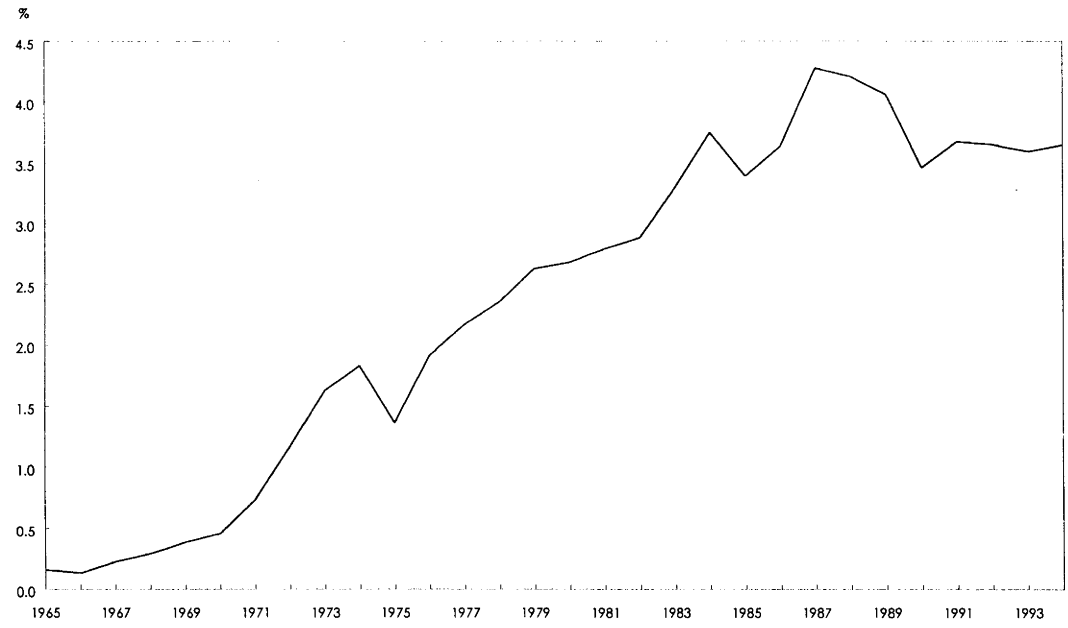
Table 3.8: Importance of Australia to Taiwan as a Trading Partner, 1965-94

	Share of Taiwan's Exports to Australia	*Export Market Ranking*	*Share of Taiwan's Imports from Australia*	*Import Market Ranking*
1965	0.9	10	2.3	5
1966	0.7	14	3.4	4
1967	..	..	..	..
1968	1.5	11	2.1	5
1969	1.5	11	3.0	4
1970	1.4	11	3.1	4
1971	1.7	9	3.3	4
1972	1.7	10	3.0	6
1973	2.4	10	2.7	4
1974	3.4	6	2.4	8
1975	2.4	10	2.7	7
1976	2.7	7	2.4	7
1977	2.6	7	2.5	7
1978	2.6	7	2.9	6
1979	2.6	7	3.1	6
1980	2.7	7	2.6	7
1981	3.0	5	2.8	6
1982	2.9	6	3.4	6
1983	2.5	8	3.4	6
1984	2.7	7	3.6	4
1985	2.4	7	4.0	5
1986	2.2	8	3.6	5
1987	2.1	8	2.9	5
1988	2.2	9	2.7	5
1989	2.3	8	3.1	5
1990	1.9	11	3.0	4
1991	1.8	11	3.2	4
1992	1.8	10	2.9	5
1993	1.7	10	2.7	5
1994	1.8	11	2.6	6

Note: .. Not available.

Sources: Export and Import Values from UN trade data, International Economic Databank, Australian National University; Export and Import Ranking's from Council for Economic Planning and Development (1997), *Taiwan Statistical Data Book 1996*, Taipei: Council for Economic Cooperation and Development.

Figure 3.8 Taiwan's Market Share in Australia, 1965-94



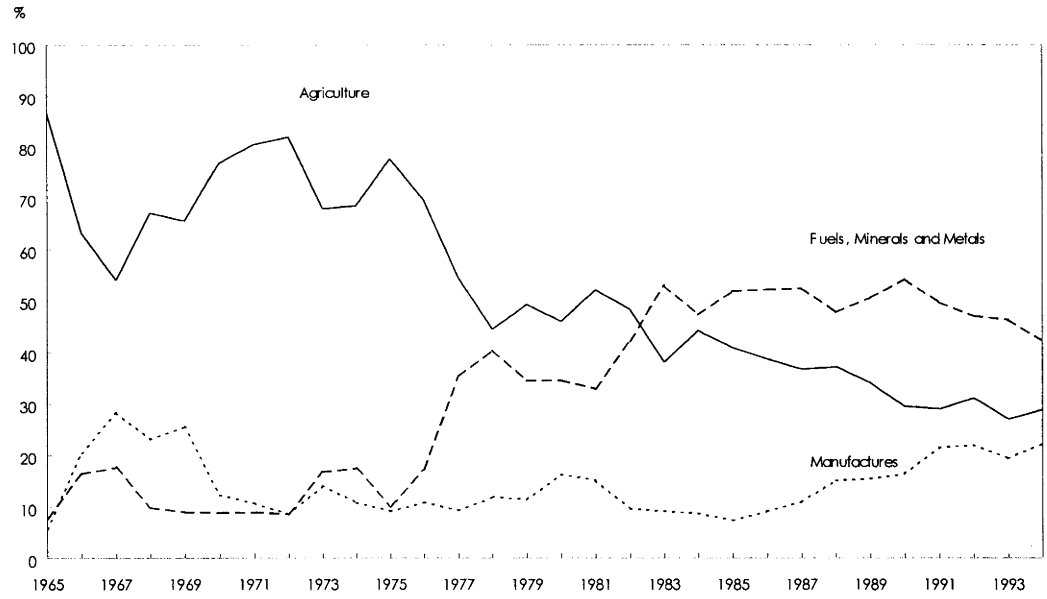
Source: UN trade data, International Economic Databank, Australian National University.

3.4.1 Composition of Australia's Exports to Taiwan

The composition of Australia's exports to Taiwan can be gleaned from both table 3.9 and figure 3.9. In 1965, Australia's exports to Taiwan were primarily agricultural-based, with unmilled wheat and wool accounting for 45 per cent and 31 per cent respectively. By 1974, barley accounted for nearly 23 per cent of exports, while unmilled wheat, milk and cream and wool each held approximately 12 per cent of exports. In 1984, Australia's exports to Taiwan had shifted towards fuels, minerals and metals, as the share of coal, coke and briquettes and iron ore increased to 25 per cent and seven per cent per cent respectively. Agriculture-based goods, on the other hand, became less important, with wool and meat being the main exports from this group (11 per cent and eight per cent respectively). By 1994, fuels, minerals and metals continued to dominate the export composition, although the share had shifted from coal, coke and briquettes (16 per cent) to aluminium (10 per cent) and copper (five per cent). The falling share of fuels, minerals and metals was at the expense of an increased share in manufacturing, with primary forms of iron and steel dominating this category (eight per cent). Fish and wool were Australia's main exports to Taiwan

from the agricultural-based category, continuing to fall in 1994.

Figure 3.9 Composition of Australia's Exports to Taiwan, 1965-94



Source: UN Trade Data, International Economic Databank, Australian National University, Canberra.

Table 3.9: Australia's Principal Export Shares to Taiwan, 1965-94

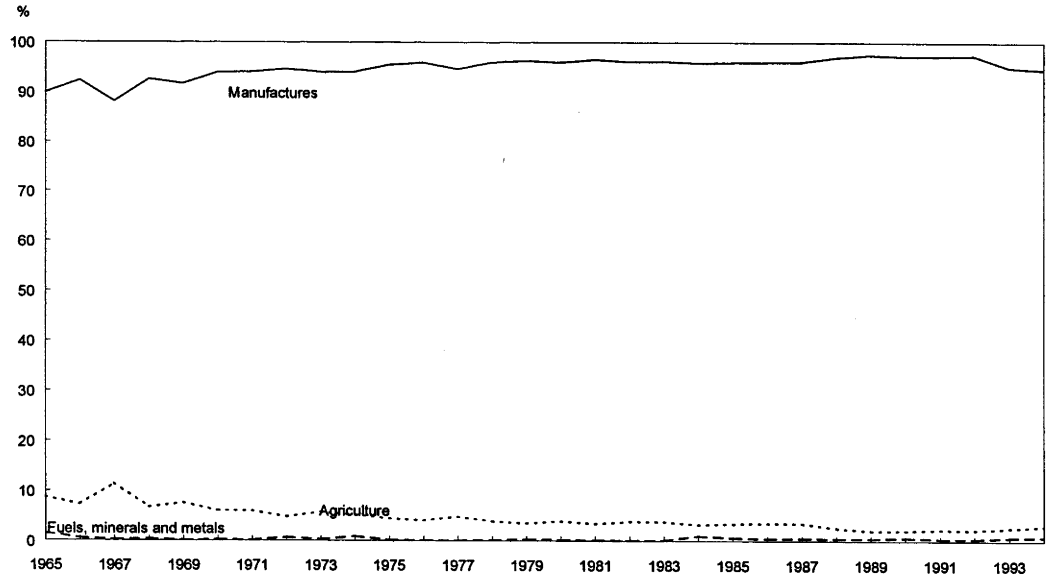
Commodity	Factor Intensity	1965	1974	1984	1994
Unmilled Wheat	NR	45.3	12.2	..	0.0
Wool and Animal Hair	NR	31.0	12.8	10.9	7.1
Iron and Steel Scrap	HC	4.0	0.6	0.4	0.3
Milk and Cream	NR	3.4	12.4	5.2	2.6
Cereal Preparations	NR	2.7	1.2	0.1	0.2
Zinc	NR	1.8	7.2	3.3	2.1
Hides and Undressed Skins	NR	1.4	0.9	0.6	0.6
Iron and steel Plates and Sheets	HC	1.3	0.9	0.5	1.2
Lead	NR	1.3	1.8	0.5	1.0
Coal, Coke and Briquettes	NR	0.4	6.1	25.2	16.0
Fresh, Chilled and Frozen Meat	NR	0.0	0.9	8.0	6.5
Aluminum	NR	..	0.1	5.8	10.0
Iron and Steel Primary Forms	HC	..	0.2	..	7.6
Fresh and Simply Preserved Fish	NR	..	0.0	0.4	7.5
Iron Ore	NR	..	..	7.3	5.4
Copper	NR	..	0.1	0.0	5.3
Cotton	NR	..	0.2	6.1	0.6
Unmilled Barley	NR	..	22.6	2.5	..

Notes: .. Not available; NR = Natural Resource-Intensive, HC = Human Capital-Intensive
Source: UN Trade Data, International Economic Databank, Australian National University.

3.4.2 Composition of Taiwan's Exports to Australia

As can be expected in an economy poorly endowed with natural resources, figure 3.10 shows that Taiwan's exports to Australia were based almost entirely on manufactures, increasing from 92 per cent in 1965 to 96 per cent in 1994. According to table 3.10, over half of these manufactures in 1965 were woven cotton fabrics, with 53 per cent of total exports. By 1974, this share had fallen steeply to seven per cent, as non-fur clothing replaced woven cotton fabrics as Taiwan's staple export to Australia, holding 27 per cent of total exports in the form of this commodity. The export composition had diversified sharply by 1984, with the share of non-fur clothing falling to nine per cent. Other important exports during this year were toys and sporting goods (seven per cent), textile yarn and thread (six per cent) and footwear (six per cent). By 1994, technology-intensive manufactures had dominated Taiwan's exports to Australia, as office machinery increased from two per cent to 28 per cent of total exports since 1984.

Figure 3.10 Composition of Taiwan's Exports to Australia, 1965-94



Source: UN trade data, International Economic Databank, Australian National University.

Table 3.10: Taiwan's Principal Export Shares to Australia, 1965-94

Commodity	Factor Intensity	1965	1974	1984	1994
Woven Cotton Fabrics	UL	53.3	6.5	0.9	0.1
Plastic Articles	UL	9.2	1.6	3.0	3.3
Organic Chemicals	T	7.2	0.3	0.9	0.8
Cement Building Materials	NR	6.1	0.0	0.1	0.1
Other Manufactures	UL	5.8	0.9	1.4	0.9
Wood Shapes	NR	4.5	0.2	0.0	0.1
Veneers and Plywood	NR	3.6	4.7	1.7	0.0
Preserved and Prepared Vegetables	NR	1.9	3.1	0.9	0.1
Toys and Sporting Goods	UL	1.8	3.5	6.7	4.3
Floor Coverings and Tapestry	UL	1.6	0.1	0.1	0.02
Furniture	UL	1.6	2.5	3.5	2.0
Non-Fur Clothing	UL	1.3	26.1	8.8	1.0
Wood Manufactures	NR	1.3	3.9	1.5	0.6
Paper and Paper-board	HC	1.1	0.0	0.1	0.2
Coal and Petroleum Chemicals	T	1.1	..	1.3	0.0
Footwear	UL	0.7	7.1	5.9	0.6
Textile Yarn and Thread	UL	0.7	4.4	5.7	3.1
Electrical Machinery	T	0.2	1.2	1.8	4.5
Travel Goods and Handbags	UL	0.1	2.1	4.2	0.5
Non-Cotton Woven Textiles	UL	0.0	1.8	4.3	3.2
Telecommunication Equipment	T	0.0	2.8	3.2	2.4
Non-Motor Road Vehicles	HC	0.0	1.2	3.6	1.6
Office Machinery	T	..	0.3	1.9	28.3
Non-Electric Machinery	T	..	0.0	1.0	4.7
Electric Power Machinery	T	..	0.5	1.2	3.1
Metal Manufactures	HC	..	0.4	2.9	3.1
Plastic Materials	T	..	3.1	2.9	2.8

Note: .. Not available; T = Technology-Intensive, NR = Natural Resource-Intensive, HC = Human Capital-Intensive, UL = Unskilled Labour-Intensive.

3.5 Trade Policy in Australia and Taiwan

3.5.1 Australian Import Policy

Traditionally, Australian import policy has consisted almost entirely of tariff protection.[14] The 1907-8 Lyne tariff was the first major import barrier introduced in Australia, which was used to reduce unemployment and increase government revenue. Tariffs were increased further in 1920-21 following the introduction of the Greene tariff to protect infant iron, steel and motor body industries. Growth in unemployment in 1929 caused another tariff rise as the government vainly attempted to shield domestic manufacturers against the depression. As a consequence, Australia had become one of the most highly protected countries in the world by the mid-1920s (Anderson and Garnaut 1986:160-1).

In 1936, tariffs were supplemented by the introduction of import licenses, which proved useful to the government during World War II to control import growth. By 1952, licences had become more widespread than tariffs as current account pressures became an overriding concern for the government (Anderson and Garnaut 1987:44, IAC 1976:27). Nonetheless, these shifts towards licences from tariffs proved temporary, as most were repelled in 1960. This was followed by a further increase in tariffs to compensate manufacturers for the loss of import licences, as well as measures to protect domestic industries against 'dumping' by foreign countries (Anderson and Garnaut 1986:161; Anderson 1987:177, IAC 1976:29). The government did not face any international pressure to repeal the tariff rises, largely because of its refusal to participate in the Kennedy GATT trade rounds during the 1960s (Anderson 1987:177).

[14] This was except for the period between 1958-60, where 98 per cent of Australian imports were subject to licenses (IAC 1976:27).

Hence, Australian import policy became progressively more restrictive between Federation and the 1960s.[15] It was not until July 1973 that the government began to relax the stance of import policy, when nominal tariffs were cut by 25 per cent across the economy.[16] By increasing domestic competition and the supply of goods, tariff falls were considered an effective weapon against inflationary pressures from growing foreign exchange reserves during 1971 and 1972 (OECD 1975:60, Conlon 1985:16). Falling living standards and mineral sector competitiveness had also brought the negative effects of tariffs to the government's attention (Anderson and Garnaut 1986:174-5; Krause 1984:289-90).

The policy of import liberalisation was temporarily postponed during 1974-5 following the introduction of quotas and voluntary export restraints (IAC 1987:62). The 1973 tariff cut had impacted harshly on employment levels in the manufacturing sector and was compounded by a domestic recession, wage inflation and an appreciating currency (Stanford 1992:40). Industries with the highest tariff rates (namely textiles, clothing and footwear (TFC) and passenger motor vehicles (PMV)) were especially prone to adjustment problems. As such, quotas were removed for all industries except for the TCF and PMV industries when economic conditions improved (Anderson and Garnaut 1987:52).[17] As the policy was unsuccessful in raising employment levels, the shift in policy stance was ultimately deemed as a failure (Garnaut and Anderson 1980:407).

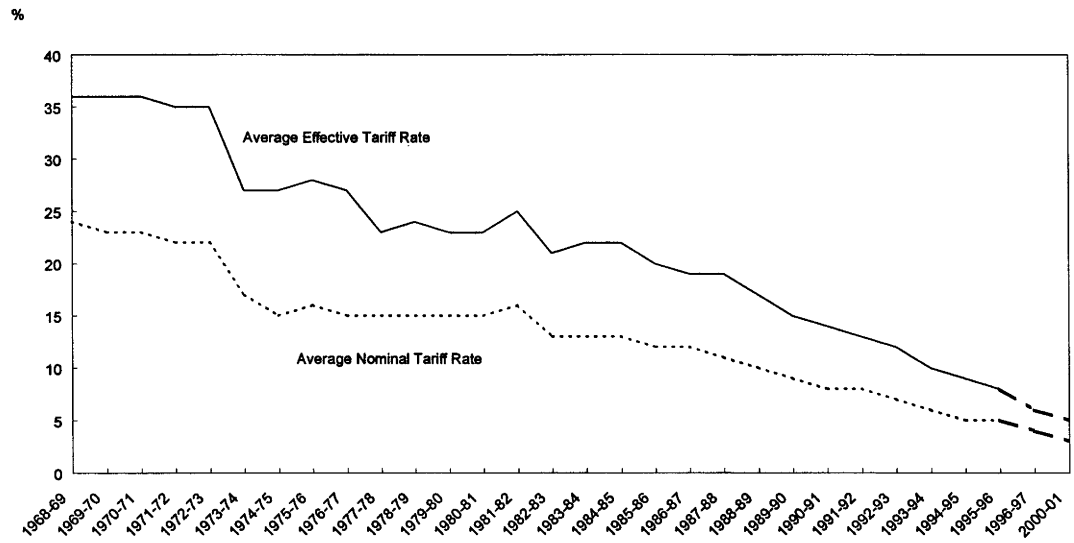
In January 1977, the government resumed trade reforms by reducing tariffs on 900 imported items.[18] The decision to participate in the Tokyo Round of GATT talks and improve the export capability of domestic manufacturers had motivated the tariff cuts (OECD 1975:61, IAC 1987:107). While the 900 items targeted for a tariff reduction were widely criticised as being those least affected by tariff cuts, the 1977 reforms

[15] The removal of import licenses, as well as the liberalisation of Australia-Japan trading arrangements, were the only declines in import protection recorded prior to 1973 (Anderson and Garnaut 1987:50).
[16] The fall was only eight per cent when the effective rate of protection (nominal rate of protection on output less nominal rate of protection on inputs) was taken into account (IC 1995:33).
[17] Quota assistance to the PMV and TCF industries continued until April 1988 and March 1993 respectively (IC 1995:34).
[18] The 1977 tariff falls were less potent than the 1973 cuts, reducing the effective rate of protection by only three per cent (IC 1995:33).

are believed to have had a wide-ranging impact on the domestic economy. This was evidenced by the increase in the import consumption share soon after the cuts (Anderson and Garnaut 1987:53).

It was not until over a decade later with the announcement of the May 1988 Economic Statement that the Australian government embarked on a further round of tariff reductions.[19] A worsening current account deficit and a view that lower tariffs would improve export competitiveness had prompted the reforms. The government used a 'top-down' rather than an 'across-the-board' approach adopted in 1973, as the government targeted industries with the highest tariff rates (Stanford 1992:42-3). Industries with tariffs above 15 per cent were reduced to 15 per cent, while tariffs between 15 per cent and ten per cent were scheduled to fall to ten per cent in 1992 (IC 1995:34). Notably, the TCF and PMV industries were excluded from the tariff falls due to intensive lobbying by industry representatives and the labour-intensive nature of the industry (Anderson and Garnaut 1986:175).

Figure 3.11 Average Nominal and Effective Tariff Rates in the Australian Manufacturing Sector, 1968/69-2000/01



Note: 1995-96, 1996-97 and 2000-01 tariffs were levels projected by the Industry Commission.
Source: Industry Commission (1995), *Assistance to Agricultural and Manufacturing Industries*, Information Paper, March, Canberra: AGPS.

[19] Stanford (1992:40-1) argued that adverse economic conditions during the early 1980s were the main factor behind this delay.

The March 1991 Industry Policy Statement completed the fourth round of tariff falls. The Statement extended the 1988 reforms by reducing the effective rate of assistance to five per cent by July 1996, as well as abolishing all quotas, as shown by figure 3.11. The tariff falls were designed to force improvements in productivity and international competitiveness in Australian manufacturing (GATT 1994a:18). The Statement addressed for the first time tariff levels in the PMV and TCF industries, which were scheduled to fall to 15 per cent by July 2000.[20] The reforms also removed Developing Country tariff preferences for the Republic of Korea, Taiwan, Hong Kong and Singapore after 1992, given that they no longer qualified for developing country status (IC 1993-94:306). The 1991 reforms overall had a positive effect by reducing the effective rate of protection to ten per cent by 1993-94, but was negated to some extent by the decision to introduce fast-track anti-dumping complaints (IC 1995:35, Price Waterhouse 1991:5).[21]

The latest tariff reviews to date were announced in 1997. The PMV and TCF industries were the focus of the revision, with PMV tariffs frozen at 15 per cent until 2005 (Howard and Moore 1997:1, Howard, Moore and Costello 1997:1). For the TCF industry tariffs were also frozen at 2000 levels. This was despite recommendations by the Productivity Commission to lower tariffs to 11 and 8.5 per cent by 2005 and five per cent by 2008 (Beazley and Crean 1997:1). While intensive industry lobbying was the main factor behind the stall in tariff reductions, it remains to be seen whether this will prevent Australia maintaining a commitment to free trade by 2010, following undertakings made in the 1994 APEC Bogor Declaration (IC 1994-95:177).[22]

3.5.2 Australian Export Policy

As was the case for Australia's import policy, government export assistance has primarily been directed towards the manufacturing sector, receiving over 75 per cent

[20] Nonetheless, tariffs in the TCF and PMV industries were over two to three times higher than other industries by 1994 (GATT 1994a: 42).
[21] The falls in TCF and PMV assistance also led to a substantial fall in the standard deviation of effective rates of protection, thereby markedly improving resource allocation.
[22] Tariff levels in the TCF industry will be lowered to 10 per cent in 2005 (Howard and Moore 1997:1).

of export grants in 1994-95. The belief that the manufacturing sector achieves greater gains from export assistance relative to other sectors appears to have been the main motive for the skewed nature of this policy (IC 1995-96:103). However, there is disagreement over whether this actually led to additional growth in manufactured exports, despite export assistance costs averaging $A1.3 billion between 1991-92 and 1996-97 (AEEMA 1997:19, Drysdale and Lu 1996:28-29, BIE 1995:95, IC 1996-97:33).[23]

The first measure adopted by the Australian government to assist exporters was in 1956 with the establishment of the Department of Trade (DOT) and the Export Payments Insurance Corporation (EPIC). The DOT enabled the government to have a greater focus on exporting activity, while EPIC was designed to insure exporters against the risk of non-payment or late re-payments. The scheme encouraged exporters to enter new markets and therefore assisted in alleviating Australia's current account difficulties at the time.

In 1961, the government announced two major export schemes - the Payroll Tax Rebate (PTR) and the Export Market Allowance Scheme (EMAS). Under the PTR, a 12.5 per cent rebate on payroll tax was granted provided exports were one per cent higher than base year levels, while the EMAS was based on the use of allowances to induce export activity.[24] 1961 also saw an amendment of EPIC to include insurance on exports regarded as being in the 'national interest'. This was extended in 1965 to include risks arising from war, insurrection and expropriation in order to promote exports to developing countries (IAC 1976:29, RCREMDGA 1989:46).

Thus, up until 1965, government assistance to exporters consisted primarily of tax rebates and insurance facilities. By the early 1970s, the Australian government chose to adopt a system of export grants which was, in part, prompted by the shift in payroll tax responsibilities to the states in 1971. The EMAS and EMDA were merged

[22] Tariff levels in the TCF industry will be lowered to 10 per cent in 2005 (Howard and Moore 1997:1).
[23] The IC (1996-97:32) noted that over 80 per cent of export growth between 1986-87 and 1995-96 was from manufacturing industries without export assistance.
[24] The EMAS was based on income tax rebates after 1968 (IAC 1976:25).

to form the Export Market Development Grants Scheme (EMDGS) in 1974.[25] This enabled the government to reduce overall export outlays and shift the focus of policy towards export market promotion, as well as to assist manufacturers adversely affected by the 1973 tariff cuts. The EMDGS involved rebating a percentage of the costs involved in marketing Australian goods, services, industrial property rights and know-how in established or new overseas markets (IC 1995-96:98, RCREMDGA 1989:46-7, Krause 1984:290).[26] Conditions for eligibility to the scheme have varied following various reviews to maximise efficiency and effectiveness and continue to be the main form of government assistance to exporters to date, as shown by tables 3.11 and 3.12.

[25] An additional scheme based on the same principle as EMDGS, the Export Expansion Grants Scheme (EEGS), was introduced in 1978 but lasted only four years (RCREMDGA 1989:48).
[26] This included expenditures such as trade exhibitions and market research and development.

Table 3.11: Export Grant Payments, 1991-97 ($Am)

Year	*Export Finance & Insurance Facilities*			*Export Marketing and Promotional Services*									
	Development Import Finance Facility	Export Finance & Insurance Corporation	Export Finance Facility Interest Subsidy	Agri-Food Industry Program	Asia Business Links	Asian Infrastructure Initiative	Australia In Asia	Australian Horticultural Corporation	Australian Tourist Commission	Australian Wool Corporation Wool Export Promotion	Clean Food Export Strategy	Export Access Program	Export Market Development Grants Scheme
1991-92	98.0	25.0	10.9	-	-	-	-	1.5	69.5	32.1	-	1.0	134.0
1992-93	120.0	21.1	9.4	0.2	0.1	-	0.2	2.5	74.5	25.0	..	4.2	148.0
1993-94	120.0	19.6	6.0	1.3	1.6	-	5.7	2.2	77.2	20.0	2.0	6.1	209.7
1994-95	130.0	18.0	5.1	3.3	2.1	3.0	2.8	1.5	79.3	-	1.2	5.4	211.3
1995-96	126.5	16.5	0.1	2.5	2.6	1.3	2.9	1.3	80.3	-	2.4	3.1	219.5
1996-97	19.6	ne	-	2.5	-	-	1.4	1.0	76.8	-	-	3.4	204.6

Notes : - Program disbanded or not in operation.

.. Not Available.

ne Not Estimated

Sources : Australian Trade Commission, *Annual Report*, 1991-92, 1994-95,1995-96, 1996-97; Industry Commission, *Annual Report*, 1995-96.

Table 3.12: Amendments to the Export Market Development Grant Scheme

Year	Review	Outcome
1974	Original Scheme Introduced	- Between 85 and 60 per cent of eligible expenditure rebated - Export performance test - Maximum payment limit
1978	Industries Assistance Commission	- 70 per cent of eligible expenditures rebated - Travel and tourist industries become eligible - Minimum $10,000 export earnings threshold for industrial property rights - Minimum $25,000 export earnings threshold for remaining claims - Export Expansion Grants Scheme introduced
1982	Industries Assistance Commission	- Export Expansion Grants Scheme abolished - Maximum annual payment under EMDGS increased to $200,000 - Introduction of accommodation allowance - Consultancy and construction industries become eligible
1985	Ferris Report	- Firms with export earnings over $20 million excluded from EMDGS - Minimum $5,000 export earnings threshold - Export performance test in second year of exporting - EMDGS extended until 1990
1988	Bureau of Industry Economics	- Exports to New Zealand excluded from EMDGS - Minimum $10,000 export earnings threshold - More stringent export performance test
1990-1	Auditor-General	- Extended for five years.
1996-7	Commonwealth Federal Budget	- Restricted to firms generating less than $50 million in export receipts - Minimum marketing expenditure reduced to $20,000 - Tightening of claimable expenses

Sources: Report of the Committee for Review of Export Market Development Assistance (1989), Australian Exports -Performance, Obstacles and Issues of Assistance, Canberra: AGPS; Industry Commission (1996-97), Annual Report, Canberra: AGPS.

However, the increased focus on export market development in the early 1970s did not spell the end of alternative government export initiatives. In 1975, EPIC was expanded to form the Export Finance and Insurance Corporation (EFIC). EFIC, which includes the Development Import Finance Facility (DIFF), the Government Guarantee and the Export Finance Facility (EFF) interest subsidy, focuses mainly on assisting capital equipment and machinery exporters compete for development projects in low-income countries.[27] However EFIC was limited to only the provision of export insurance after 1995 as the EFF interest subsidy and DIFF scheme were abolished in the 1995-96 Federal budget (RCREMDGA 1989:51, IC 1993-94:253, 1995-96:100).

After the mid-1980s, the stance of export policy had shifted to an industry-specific approach.[28] Among the industries targeted by the government, the PMV, pharmaceutical and TCF industries received the highest share of export assistance. While increased export volumes were the main objective for policies targeting the PMV and TCF industries, this formed only part of the total assistance package for the remaining industries.

Assistance to PMV exports first began with the introduction of the Passenger Motor Vehicle Plan or 'Button' Plan in 1985. The plan encouraged exports by allowing components or vehicles to be imported duty free (up to a value equal to 20 per cent of local content) in exchange for exports of vehicles and equipment. After the removal of the local content scheme in 1989, the duty free rebate was made equivalent to the level of tariffs.[29] This meant that export assistance in the PMV industry has fallen in accordance with tariff falls, thereby allowing for improved competitiveness with minimal government assistance. The plan has been beneficial in that the quality of Australian vehicles increased, although it did not enable the industry to meet anticipated export goals and has increased prices for domestic consumers (Bora and Pomfret 1995:104, RCREMDG 1989:89, Sheehan, Pappas and Cheng 1994:92).

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[27] Up to 50 per cent of the contract value is subsidised by the government as long as construction materials are Australian-made, which is comparable to subsidies offered by overseas governments.
[28] Despite this the EMDGS continued to receive most of the government's export outlays,
[29] For example, $100 worth of exports would allow for a $25 rebate on $100 worth of imports if tariff rates were 25 per cent (IC 1995-96:101).

The second industry-specific export policy began in 1988 with the Factor (f) program. The program encouraged pharmaceutical firms by paying higher prices to increase production, research and development and export volumes.[30] Although the first stage of the program specified that participating firms have half of their import volumes in the form of exports, the second stage (introduced in 1993) removed this requirement. Despite this, the scheme generated $416 million dollars in export value added in the years following its introduction and has consequently been regarded as a success (Sheehan, Pappas and Cheng 1994:87, GATT 1992a:72).

Export assistance to the TCF industry was introduced in July 1991, following the March 1991 Industry Policy Statement (Price Waterhouse 1991:13). The Import Credit Scheme, based on a similar principle as the PMV export plan, rebated TCF import duties on a percentage of export value added. While this proportion is scheduled to fall to 15 per cent in 1999 from the original 30 per cent in 1991, the scheme is set to be abolished after 2000 despite assisting a rise in TCF exports to nearly $1 billion in 1997 (Beazley and Crean 1997:1, IC 1995-96:119).

3.5.3 Taiwanese Import Policy

Taiwan first introduced measures to assist import-competing industries in 1951 (Scott 1979:314). Severe balance of payments difficulties had prompted the government to initiate this policy as a consequence of foreign exchange reserves falling to chronically low levels (De La Cuesta 1995:225). The government also wanted to transform Taiwan from a predominantly agrarian economy to an industrialised economy by protecting infant industries such as plastics, artificial fibre, paper, glass, cement, fertiliser, plywood and textiles. Multiple exchange rates, tariffs, licences and quotas were each used to achieve this purpose (Scott 1979:315). The exchange rate was used to tax imports of consumer goods, while over half of Taiwan's imports were subject to nominal tariff levels exceeding 30 per cent, as table 3.13 shows.

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rates were 25 per cent (IC 1995-96:101).

[30] The higher prices were paid to pharmaceutical firms under the Pharmaceutical Benefits Scheme

Table 3.13: Nominal Tariff Rates in Taiwan, 1948-65

Tariff Rates	1948	1955	1959	1965
< 30%	39.6	38.7	48.0	49.7
30-50%	28.7	29.8	22.7	23.9
50-100%	21.5	20.0	21.1	20.4
> 100%	10.2	11.4	8.2	6.0

Source: Hsing, M., (1971), *Taiwan - Industrialisation and Trade Policies*, London: Oxford University Press, table 5.4:210.

Despite the prohibitive nature of Taiwan's tariff structure, quantitative restrictions were the main policy tool for restricting import growth. Imports were classified as being either controlled, where imports were possible when a domestic substitute was unavailable, prohibited, consisting of imports such as alcohol and cigarettes, or permissible, where an import license was readily obtainable (Hsing 1971:210). According to table 3.14, the share of permissible imports had increased sharply by 1972, while prohibited and controlled imports saw a corresponding decline. While this would seem to suggest Taiwan adopted a more liberal stance towards import control after this year, Wade (1990:129-30), who found permissible imports were subject to strict country-of-origin restrictions and a 'referral' system, disputed this.[31]

Table 3.14: Import Controls by Class, 1968-76

Year	Prohibited	Controlled	Permissible
1968	1.9	41.4	56.7
1970	1.8	41.9	56.3
1972	0.0	18.4	81.6
1974	0.0	3.0	97.0
1976	0.1	3.5	96.5

Source: Scott, M. (1979), 'Foreign Trade', in Ranis, G. (ed.), *Economic Growth and Structural Change in Taiwan*, London: Cornell University Press, table 5.4:331.

Taiwan's import controls and tariffs remained prevalent until 1984 when wide-ranging economic reforms were announced. The threat of retaliatory action by the

(PBS).

[31] The 'referral' system required that importers obtain a document from a domestic supplier stating that they could not meet the price, quality and delivery needs of the importer before approval to import was

United States in 1985 to remedy a chronic bilateral trade imbalance, as well as a recognition that reduced import restrictions were necessary to improve the efficiency and competitiveness of domestic firms, were the main factors underlying the reforms.[32] By 1987, only 1.5 per cent of imports was subject to bans, controls or delays, while import origin restrictions were eliminated. By 1991, the average effective tariff rate fell to 4.8 per cent, while tariffs were lowered on 1,908 products in 1992 (De La Cuesta 1995:229, Schive 1995:14).

3.5.4 Taiwanese Export Policy

The adoption of an export policy by Taiwan's government in the late 1950s was precipitated by several factors. First, economic growth had stagnated by the end of the decade, despite annual growth rates of 10 per cent in previous years (Scott 1979:315, Ranis 1979:221). Second, Taiwan's domestic economy was of insufficient size to allow for continued development in protected industries, as evidenced by growing excess capacity. Third, Taiwan's import policies had done little to aid the current account deficit as it had only shifted the composition, rather than the total volume, of imports.[33] Fourth, foreign aid from the United States was due to expire, creating an urgency for alternative foreign exchange sources (Rabushka 1987:120,125). And fifth, the international trade environment during this period was highly favourable to export-led development and, therefore, policies to promote this process (UNIDO 1986:56).

As a consequence of these factors, Taiwan formally adopted an export promotion policy in April 1958.[34] The first step taken by the government was the unification and depreciation of the NT dollar, in nominal terms, by 250 percent (Riedel 1992:295). The government then reduced import controls to minimise not only the penalty on

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granted (Wade 1990:129-30).

[32] This was the main source of external pressure for reducing import barriers, given that Taiwan is not a member of GATT.

[33] Capital goods imports increased from 13.1 per cent to 29.5 per cent of total imports between 1952 and 1965 respectively, while consumer imports fell from 12.7 per cent to 7.8 per cent over the same period (Chang 1968:254).

[34] The government had introduced tax rebates and subsidised loans in 1954 and 1957 respectively.

exporters, but also inflationary pressures arising from the heavily depreciated currency (Scott 1979:328).[35]

The second measure undertaken by the government was an increase in accessibility to commodity, harbour, salt, and slaughter and defence duty rebates. Rebates were an important incentive for exporting, as these taxes had made it unprofitable to engage in exports (Scott 1979:321-2, Chang 1968:264). The effectiveness of this scheme was, however, offset to some extent by the bureaucratic delays in processing rebate claims (Hsing 1971:215, Scott 1979:326).

Table 3.15: Share of Export Loans in Total Loans - Taiwan, 1972-81

Year	Share of Export Loans in Total Loans
1972	6.3
1973	5.8
1974	3.5
1975	2.8
1976	2.8
1977	3.0
1978	2.8
1979	2.3
1981	2.1

Sources: Figures for 1972-1979 from Kuo, S.W.Y. Ranis, G. and Fei, J.C.H. (1981), *The Taiwan Success Story: Rapid Growth with Improved Distribution in the Republic of China, 1952-1979*, Colorado: Westview Press, table 4.4:80; 1981 figure from Wade, R. (1990), *Governing the Market*, Princeton: Princeton University Press, p.142.

The third measure was an increase in the availability of export loans at heavily subsidised rates.[36] As shown by table 3.15, these loans did not appear to be an

[35] However, according to Wade (1988:43) and Li (1988:44), the government introduced secondary import substitution policies for the petrochemical, basic metal, shipbuilding, aluminium and automobile industries at the same time export promotion policies were introduced that continued well into the 1970s.

[36] The annual interest rate on export loans in 1957 was six per cent, compared to 19.8 and 22.3 per cent

important source of finance to exporters. The loans were primarily used by exporters to re-lend on the curb market to earn large profits, leading to an equalisation of rates in the mid-1970s. As a result, firms have turned to non-bank institutions, in particular Japanese trading companies and large upstream firms, to finance export ventures (Wade 1990:142).

Table 3.16: Total Establishments and Export Share from EPZs, 1966-90

Year	Total Establishments	Share of Total Exports
1966	..	0.1
1967	..	1.2
1968	..	3.4
1969	..	6.0
1970	..	7.8
1971	..	8.4
1972	..	8.5
1973	..	9.7
1974	..	9.6
1977	291	8.0
1978	295	7.1
1979	303	7.6
1980	296	7.2
1981	297	7.0
1982	289	7.3
1983	283	6.4
1984	271	6.7
1985	252	6.1
1986	252	6.1
1987	252	5.9
1988	246	6.2
1989	239	5.9
1990	235	5.3

Notes: .. Not available; Figures represent combined total from Kaohsuing, Nantzu and Taichung EPZs.

Sources: Pre-1974 and total export share figures from Ranis, G. (1979), 'Industrial Development' in Galenson, W. (ed.), *Economic Growth and Structural Change in Taiwan*, London: Cornell University Press, table 3.19: 238; post-1977 total export share figures from Ministry of Economic Affairs (1991), *1990 Economic Statistics Annual - Taiwan* Area, The Republic of China, Department of Statistics, July.

respectively for secured and unsecured loans (Wade 1990:143).

Export processing zones (EPZs) were the fourth main form of export assistance provided by the Taiwanese government. The zones were designed to attract direct foreign investment in export-oriented industries by providing duty-free imports, the necessary infrastructure, and government offices to fast track tax rebates (Scott 1979:337). The zones, located in Kaohsiung, Nantze and Taichung, produced electronics, plastics and garments to take advantage of Taiwan's relatively inexpensive labour at the time (Li 1988:29).[37] According to table 3.16, the share of total exports and firm numbers in EPZs had peaked during the 1970s, becoming progressively less important thereafter.

The main reason for the falling share of EPZ exports in total exports was that both domestic labour shortages and appreciation of the NT dollar increased the cost of unskilled labour, thereby reducing the attractiveness of the zones to investors. As a result, the three export processing zones no longer produce labour-intensive goods. The Taiwanese government has sought to facilitate this shift in comparative advantage by developing several science parks to produce capital-intensive and technology-intensive manufactures (De La Cuesta 1995:227).

In addition to the government export schemes outlined above, several schemes have been operated by the private sector. Export cartels were established by private enterprises in the steel, paper, rubber and textiles industries in the late 1950s (Wade 1990:143).[38] The collusive agreements reduced 'excessive' competition and dispersed valuable export information. The cartels were funded by contributions to a co-operative fund from participating firms, with bonuses paid to firms that exceeded minimum export production quotas. Firms that did not meet the export quota were penalised with a levy (Alam 1989:64). Although Liang and Liang (1981:64) argued that cartel schemes ended in 1972 with the cotton-spinning scheme, Wade (1990:144) found these collusive agreements were still in place by 1990.

The China External Trade Development Council (CETRA) was the second main

[37] The government also established bonded factories, or EPZs located outside the three official zones, for this purpose (Ranis 1979:225).
[38] Government permission was, nonetheless, required for their operation.

scheme operated by the private sector, despite its formation by the government in 1970. The main function of CETRA is to identify and assist domestic firms gain export markets through measures such as trade exhibitions and delegations. CETRA employee numbers increased from 300 to 850 between 1977 and 1995 respectively for this purpose, while the number of overseas agents increased to 42 in 1983. Surprisingly, part of CETRA's function involves assisting foreign firms gain market share in Taiwan, possibly to reduce international criticism on Taiwan for assisting local exporters. Participating exporters and importers pay a levy on 0.05 per cent of total exports and imports respectively for the services of CETRA (Wade 1990:145-6, De La Cuesta 1995:228).

3.6 Conclusion

This chapter utilised several indicators to glean the importance of manufacturing and foreign trade to the Taiwanese and Australian economies. As expected in an economy scarcely endowed with natural resources, manufacturing held a larger share of GDP, employment and exports in Taiwan relative to Australia. The falling shares observed in both countries for each of these indicators was attributable to factors such as Taiwan's appreciating currency during the 1980s, while for Australia both endogenous and exogenous factors (falling tariffs, a resources boom, structural changes) precipitated declines after the 1960s. Only the manufactured import share was found to be higher in Australia than Taiwan, although the shares had become comparable by the early 1990s.

In terms of foreign trade, Taiwan was found to have a trade intensity ratio far in excess of the major industrialised countries, including Australia. Differences in natural resource endowments and domestic economy size appear to be the main factors underlying this result. The recent trade reforms and re-orientation of Australian trade towards East Asia are likely to have caused the rising trade/GDP ratio for Australia since the early 1980s.

The second main topic addressed in this chapter was the importance of foreign trade between Australia and Taiwan. With the use of various indicators such as export and import ranking's and shares, it was found that Taiwan has become more important to Australia as a trading partner, although not to an extent sufficient to retain market share. However, the same indicators revealed that Australia had become relatively less important to Taiwan as a trading partner up until 1994. Nonetheless, Australia's import and export ranking remained relatively high, at 6th and 11th position respectively by 1994.

Australian and Taiwanese trade policy was addressed in the third section, given this is the main distortion to the RCA index values discussed in the next chapter. The review of Taiwan's trade policy showed that the government actively sought to substitute imports with domestic production before the late 1950s using prohibitive import controls and tariffs. The need to earn foreign exchange in the late 1950s shifted the policy stance towards intensive export promotion using a complex web of rebates, subsidies, free trade zones, cartels and marketing schemes. For Australia, trade policy consisted mainly of high tariff barriers to protect domestic manufactures against import competition. This situation prevailed until the early 1970s, where major trade reforms were enacted. Since then, trade policy has shifted towards minimal import protection combined with the promotion of manufactured exports, although this commitment has waned in recent years.

- CHAPTER FOUR -

COMPARATIVE ADVANTAGE OF TRADE IN MANUFACTURES BETWEEN AUSTRALIA AND TAIWAN, 1965-94

4.1 Introduction

The previous chapter discussed the importance of manufacturing and foreign trade for Australia and Taiwan in terms of GDP, employment, trade and trade intensity ratios. The trade policies pursued by both countries were also reviewed, on the grounds that they have the potential to influence RCA index values. We now move on to a discussion of RCA index values in this chapter.

As chapter four will involve an assessment of comparative advantage between Australia and Taiwan, the first section will discuss how the RCA methodology will be adjusted for this process. Once the methodology has been applied, the results will be examined in the following section. The RCA index results will then be examined to determine whether comparative advantage has become increasingly competitive or complementary between Australia and Taiwan. The final section will conclude and summarise the main findings in this chapter.

4.2 Methodology

In chapter two, the methodology for the original Balassa (1965) RCA index was presented. While this can be used to reveal comparative advantage for Australia/Taiwan relative to the rest of the world, it is inappropriate for assessing comparative advantage bilaterally. To remedy this deficiency, Mikic, Palac-McMiken and Ratnayake (1994) developed an alternative RCA index based upon relative market shares. Using this methodology, Australia's comparative advantage in Taiwan for industry i can be derived as follows.

(1) $$RCA_i^{A(T)} = \frac{X_i^A / \sum M_i^T}{\sum X_i^A / \sum M_i^T}$$

Where

RCA_i^A = Revealed comparative advantage for Australian industry i in Taiwan

$X_i^A / \sum M_i^T$ = Australian industry i exports as a share of industry i imports in Taiwan

$\sum X_i^A / \sum M_i^T$ = Total Australian exports as a share of total imports in Taiwan

The interpretation of the adjusted RCA index remains unchanged from the original RCA index in chapter two. That is, a comparative advantage/disadvantage is revealed when Australia's market share in Taiwan for industry i is higher/lower than the average of other countries. In this case, the adjusted RCA index value will be above/ below unity. Similarly, Taiwan's comparative advantage in Australia for industry i can be gleaned from equation two.

(2) $$RCA_i^{T(A)} = \frac{X_i^T / \sum M_i^A}{\sum X_i^T / \sum M_i^A}$$

Where

$RCA_i^{T(A)}$ = Revealed comparative advantage for Taiwan in Australia for industry i

$X_i^T / \sum M_i^A$ = Taiwanese industry i exports as a share of Australian industry i imports

$\sum X_i^T / \sum M_i^A$ = Total Taiwanese exports as a share of Australia's total imports

Equations one and two were applied to 66 Australian industries and 57 Taiwanese industries. These industries conform to the standard United Nations definition of a manufacturing industry SITC 5 – 8 less 68.[1] Three-year averages of RCA values were calculated for 1965-67, 1972-74, 1982-84 and 1992-94 to minimise yearly

[1] SITC 5 – 8 less 68 was defined previously in chapter three on page 29.

distortions. When it was not possible to do this, particularly during 1965-67 when manufacturing trade between Australia and Taiwan was concentrated in a small number of industries, single year or two-year averages were used.

Once the RCA index values were calculated, the manufacturing industries were classified according to one of four factors used most intensively in their production - natural resources, human capital, technology or unskilled labour. Industries with the lowest value added per worker were classed as unskilled labour-intensive, the highest ratios of Research and Development (R and D) expenditure to value added as technology-intensive, and relatively lower R and D to value added ratios as human capital-intensive (Krause 1984:309-11). Given that Krause regarded the location of production as the main determinant of factor intensity, physical capital was excluded on the basis that capital inflows can remedy domestic shortfalls (Krause 1984:282).[2]

Comparative advantage in this section will be presented in terms of both RCA index values and ranking's. RCA index ranking's show where changes in comparative advantage were most pronounced, while the export share of each industry will also be presented to provide some idea of their relative importance within the manufacturing sector. Industries are classed as having either gained a comparative advantage at least once, or not at all, over the period considered. Factor groups with a relatively low number of RCA index values above unity will be interpreted as reflecting a comparative disadvantage. Alternatively, factor groups with a relatively high number of RCA index values exceeding unity will be deemed to represent a comparative disadvantage.

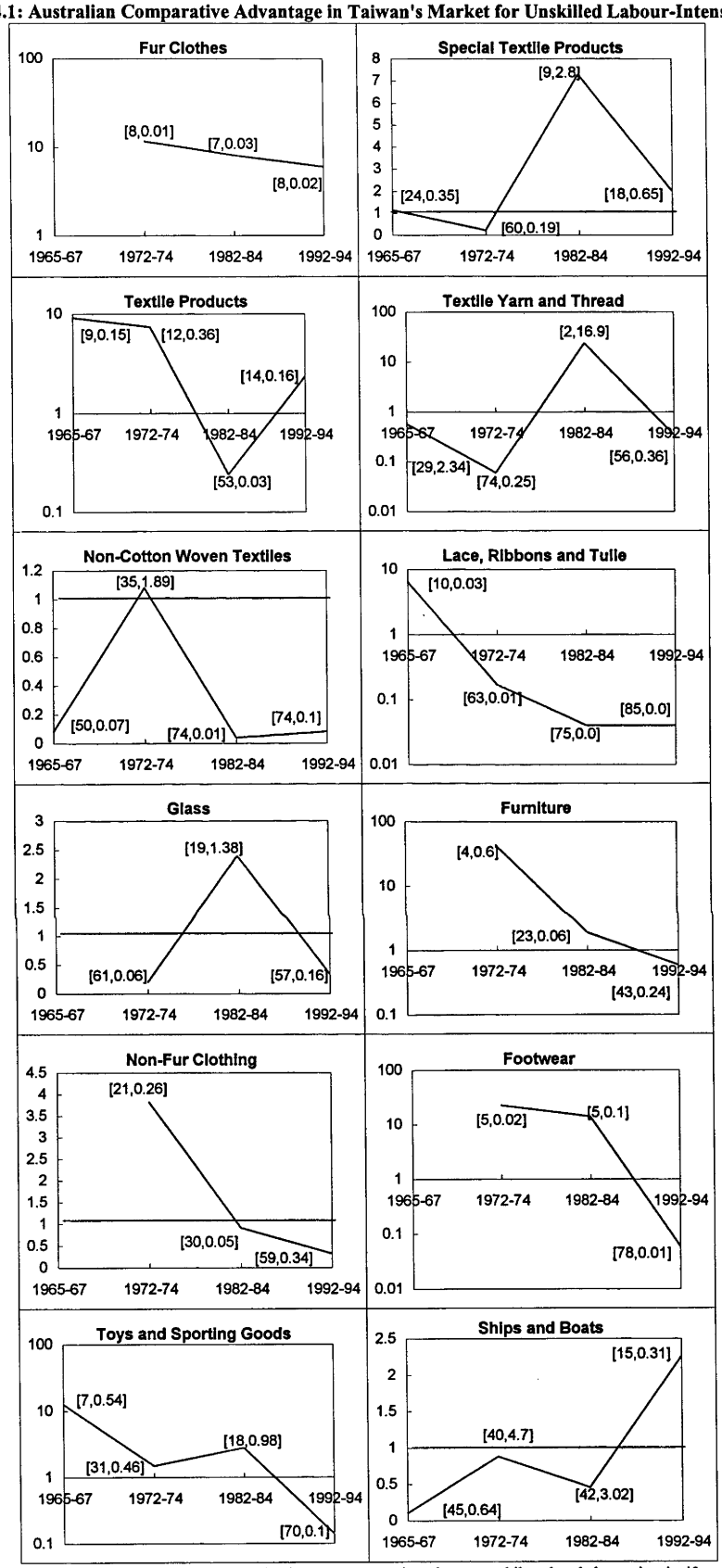
[2] It is possible that the use of the Krause classification system in the present study may present several problems. First, United States R and D expenditure and value added ratios may not be consistent with those for Australia and Taiwan. Second, technology-intensive industries may, over time, become unskilled labour-intensive as technology becomes standardised. Third, industries within each category obviously do not have identical factor intensities. Nonetheless, in the absence of an alternative classification, the Krause method was used, though with each of these problems in mind.

4.3 Comparative Advantage in Tradeable Manufactures for Australia in the Taiwanese Market

4.3.1 Australian Comparative Advantage in Taiwan's Market for Unskilled Labour-Intensive Industries

Figure 4.1 shows that Australia had developed a strong comparative disadvantage in unskilled labour-intensive manufactures by 1992-94. While 12 industries intensive in this factor had a comparative advantage by 1965-67, this was the case for only four industries by 1992-94. The sharpest falls in RCA index ranking's between this period were observed for non-cotton woven textiles (35th to 74th rank), non-fur clothing (21st to 59th rank), footwear (5th to 78th rank), lace, ribbons and tulle (10th to 85th rank), glass (19th to 57th rank), textile yarn and thread (2nd to 56th rank), furniture (4th to 43rd rank) and toys and sporting goods (18th to 70th rank). Only fur clothing maintained a relatively high RCA index ranking, falling one rank to 8th position by 1992-94. Special textile products fell from 9th to 18th rank, but were able to maintain a comparative advantage over the same period. A gain in comparative advantage was observed for only two unskilled labour-intensive industries, textile products and ships and boats, by 1992-94, rising from 53rd and 42nd rank to 14th and 15th rank respectively during this period.

Figure 4.1: Australian Comparative Advantage in Taiwan's Market for Unskilled Labour-Intensive Manufactures, 1965-94



Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

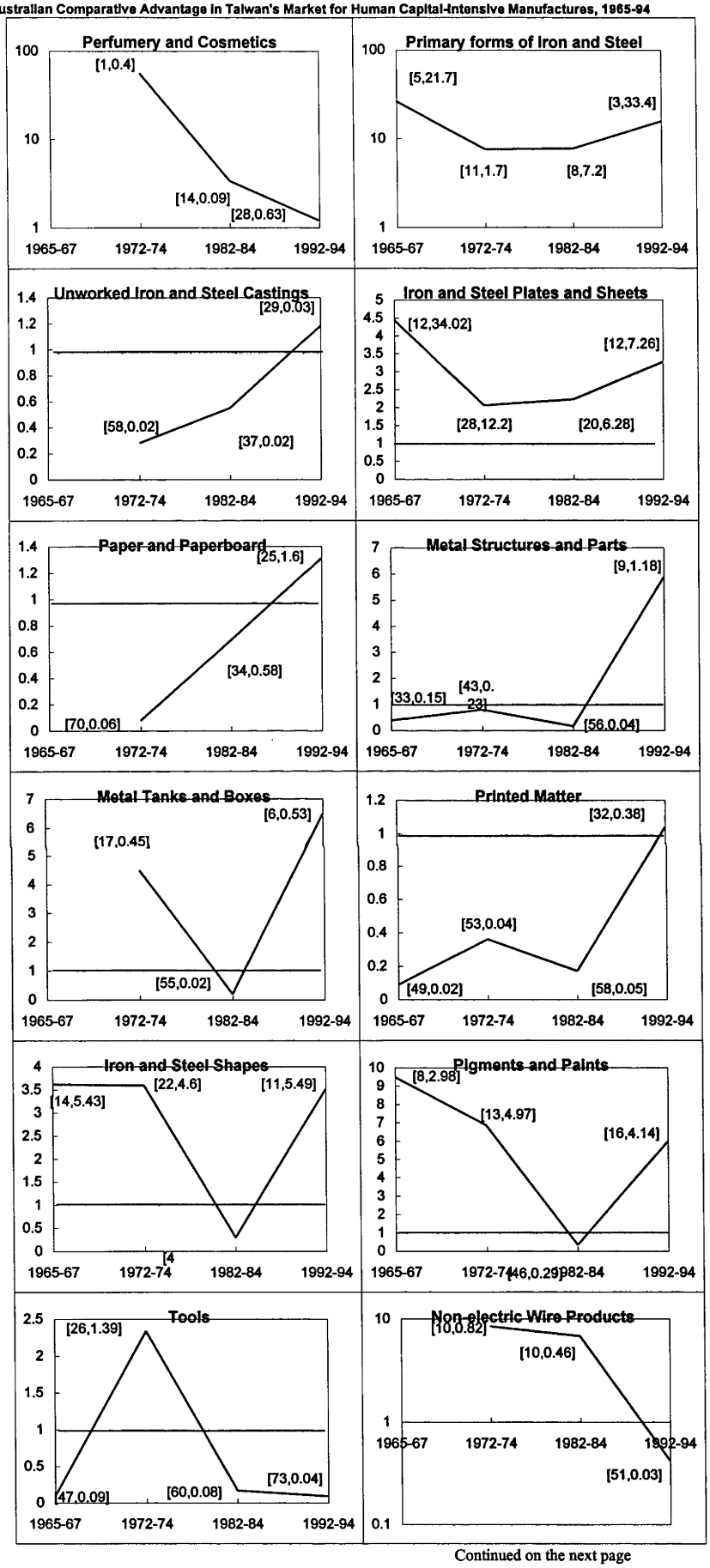
Source: UN trade data, International Economic Databank, Australian National University.

4.3.2 Australian Comparative Advantage in Taiwan's Market for Human Capital-Intensive Industries

The 22 industries listed in figure 4.2 indicate that Australia's comparative advantage was concentrated in human capital-intensive manufactures. While the number of human capital-intensive industries with an RCA index value above unity substantially increased by 1992-94, a marked decline was observed by 1982-84. Ten industries lost a comparative advantage by 1982-84, compared to four by 1992-94 and zero by 1972-74. The sharpest falls in RCA index ranking by 1982-84 were observed for metal tanks and boxes (17th to 55th rank), pigments and paints (13th to 46th rank), iron and steel shapes (22nd to 48th rank), iron and steel tubes and pipes (37th to 63rd rank), domestic electrical machinery (18th to 70th rank), tools (26th to 60th rank) and rubber articles (36th to 54th rank). By 1992-94, nine industries had gained a comparative advantage, including four that had lost a comparative advantage by 1982-84.[3] Metal tanks and boxes (55th to 6th rank), iron and steel shapes (48th to 11th rank), printed matter (58th to 32nd rank), paper and paper-board (70th to 25th rank), un-worked iron and steel castings (58th to 29th rank) and soap and cleaning preparations (59th to 21st rank), all showed the largest gains in comparative advantage by 1992-94. Three industries, perfumery and cosmetics, primary forms of iron and steel and iron and steel plates and sheets, maintained a comparative advantage throughout 1965-67 to 1992-94, with both iron and steel categories increasing their RCA index rank by 1992-94.

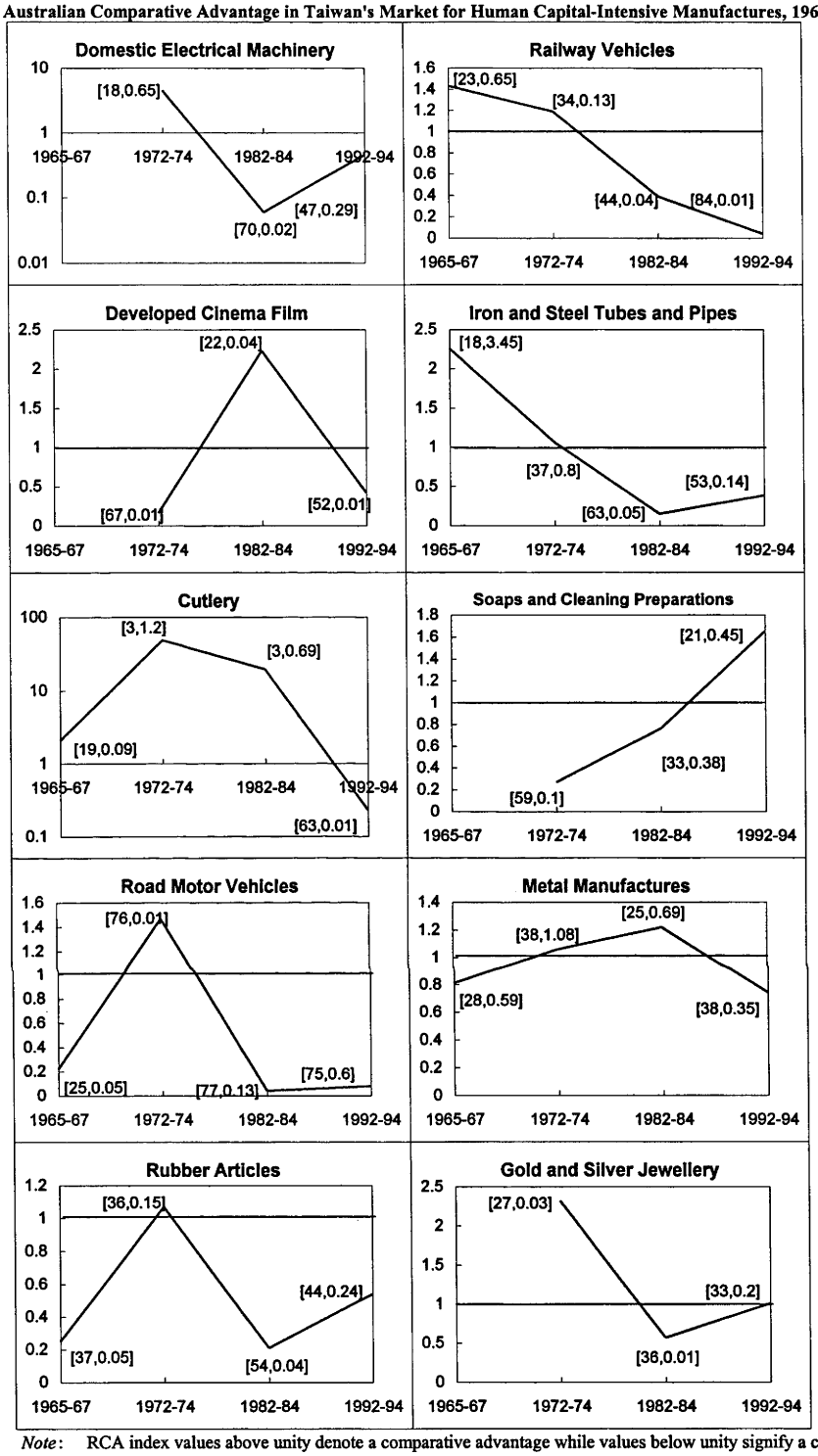
[3] This compares to two in 1982-84 and four in 1972-74.

Figure 4.2 Australian Comparative Advantage in Taiwan's Market for Human Capital-Intensive Manufactures, 1965-94



Continued on the next page

Figure 4.2 Australian Comparative Advantage in Taiwan's Market for Human Capital-Intensive Manufactures, 1965-94 (Continued)



Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

Source: UN trade data, International Economic Databank, Australian National University.

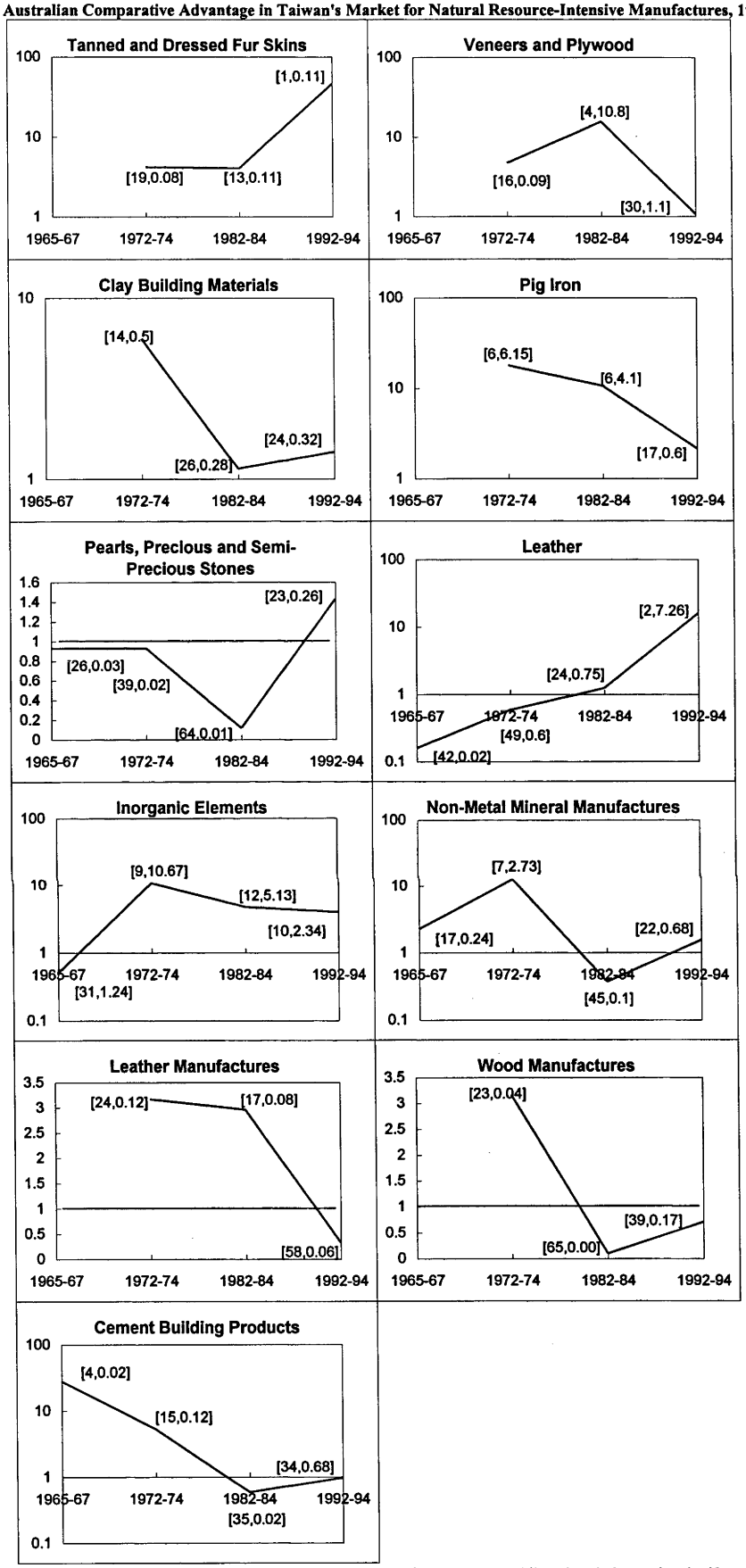
4.3.3 Australian Comparative Advantage in Taiwan's Market for Natural Resource-Intensive Manufactures[4]

The patterns of comparative advantage for human capital-intensive industries were also observed for natural resource-intensive industries. In figure 4.3, four of the 11 industries listed, (pearls, precious and semi-precious stones, non-metallic mineral manufactures, wood manufactures and cement building products) lost their comparative advantage, while three industries (inorganic elements, clay building materials, pig iron and leather manufactures) saw declines in their RCA index values, by 1982-84. The reason for the decline may have been to a fall to an 'average' RCA index value close to unity, particularly when almost all of the natural resource-intensive industries displayed very high RCA index values by 1972-74. But by 1992-94, seven industries revealed increases in their RCA index values, with comparative advantage re-gained for all industries except wood manufactures.[5]

[4] It was not possible to calculate an RCA index value for most natural resource-intensive industries in 1965-67, given that Australian exports of natural resource-intensive manufactures to Taiwan were limited during this period.

[5] This may also have been caused by an increased demand for natural resource-intensive manufactures by Taiwan's resource-poor economy to support rapid growth.

Figure 4.3 Australian Comparative Advantage in Taiwan's Market for Natural Resource-Intensive Manufactures, 1965-94



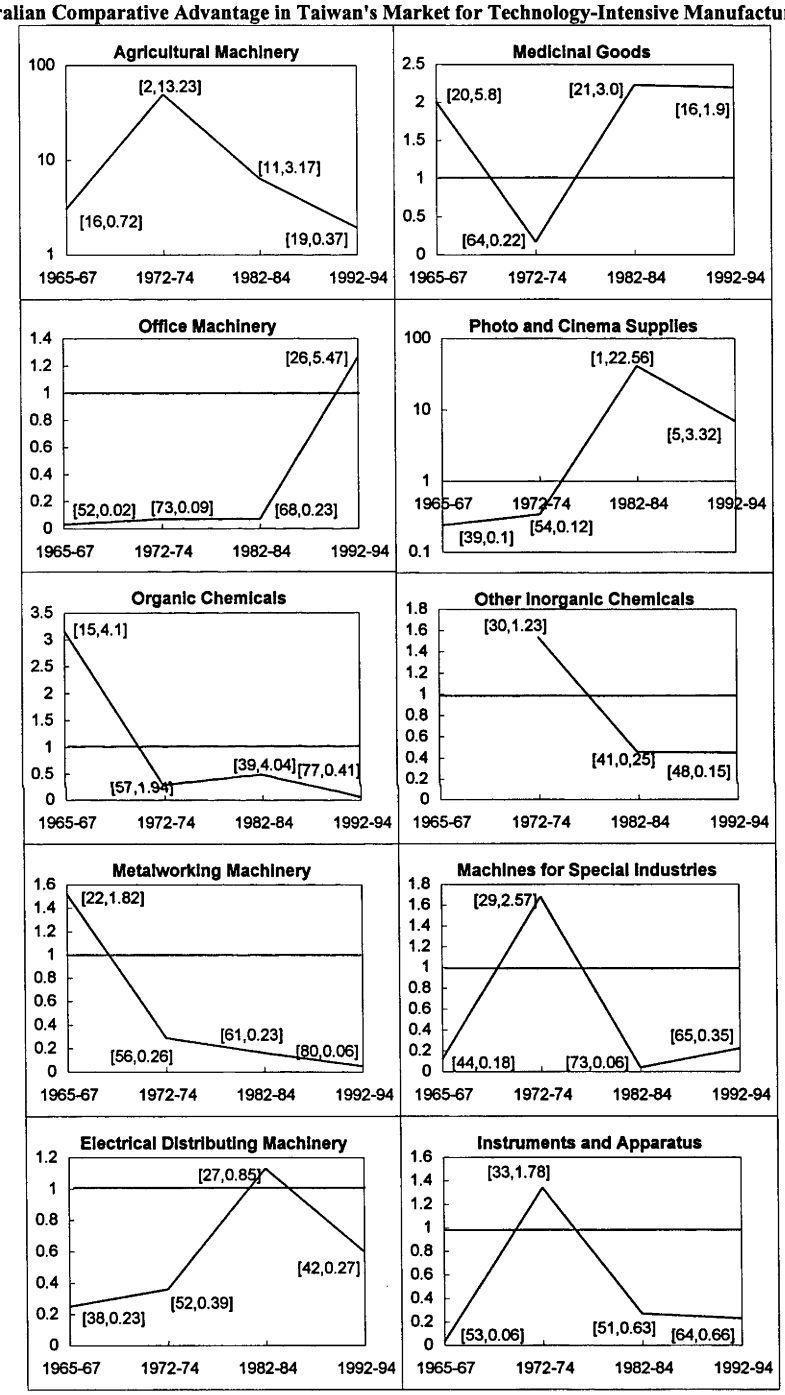
Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

Source: UN trade data, International Economic Databank, Australian National University.

4.3.4 Australian Comparative Advantage in Taiwan's Market for Technology-Intensive Industries

Australia was shown to have a comparative disadvantage in technology-intensive manufactures by 1992-94 in figure 4.4. Six of the ten industries listed, consisting of electrical distributing machinery, instruments and apparatus, machines for special industries, metalworking machinery, other organic chemicals and organic chemicals, had lost their comparative advantage, while agricultural machinery and photo and cinema supplies saw a decline in their RCA index value, by 1992-94. The remaining industries, office machinery and medical goods had respectively gained or maintained a steady RCA index value above unity by 1992-94.

Figure 4.4: Australian Comparative Advantage in Taiwan's Market for Technology-Intensive Manufactures, 1965-94



Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

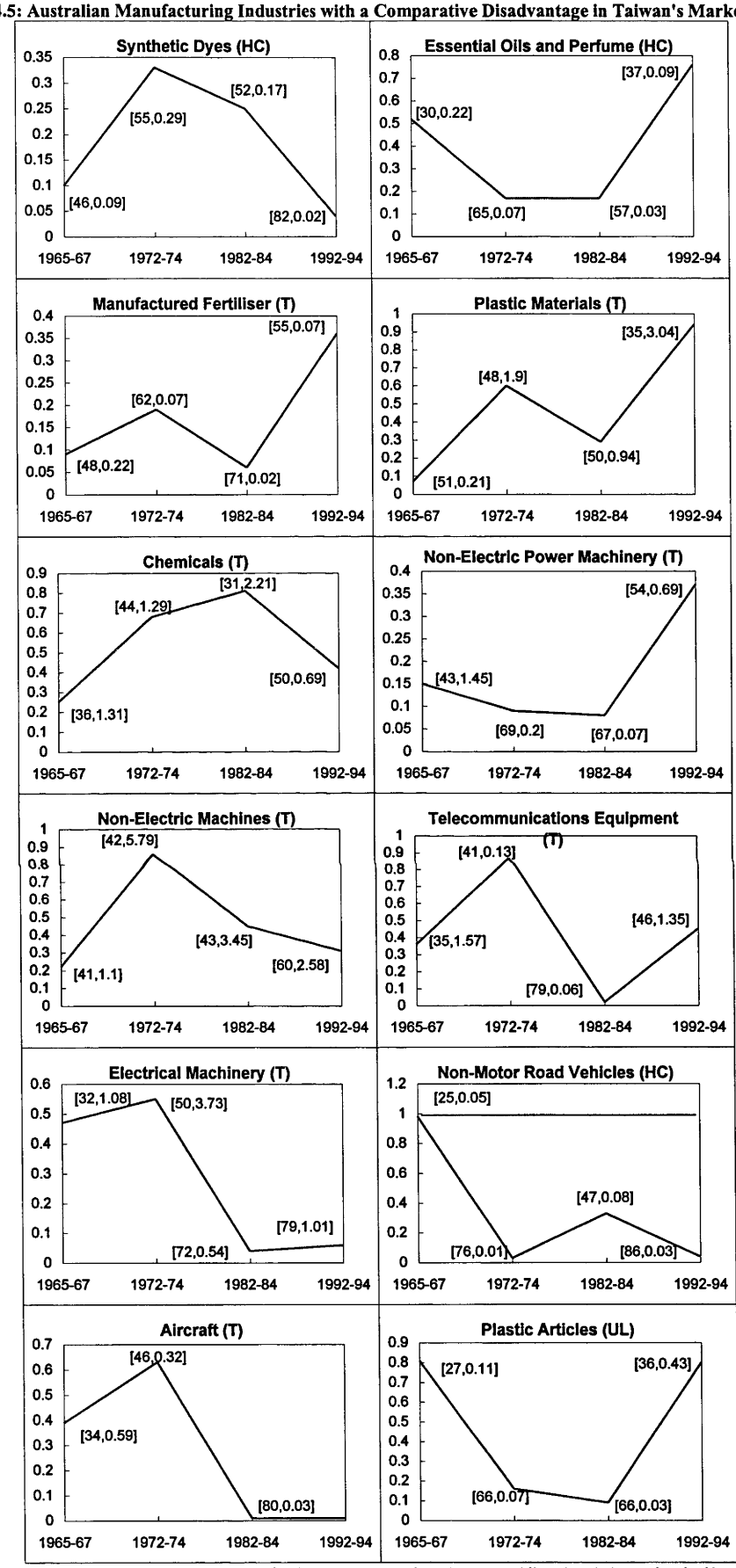
Source: UN Trade Data, International Economic Databank, Australian National University.

4.3.5 Australian Manufacturing Industries in Taiwan's Market with a Comparative Disadvantage

A total of 12 Australian manufacturing industries had a consistent comparative disadvantage between 1965-67 and 1992-94, as indicated by figure 4.5. Eight of these industries were found to be technology-intensive, consisting of both non-electric and electric machinery, chemicals, plastics, fertilisers, telecommunications equipment and aircraft. Three industries, synthetic dyes, essential oils and perfume and non-motor road vehicles, were human capital-intensive. While only one unskilled labour-intensive industry (plastic articles) consistently displayed an RCA index value below unity, the results above indicated that Australia did indeed have a comparative disadvantage in this factor by 1992-94.

In summary, Australia's comparative advantage in manufacturing trade with Taiwan was in natural resource-intensive and human capital-intensive manufactures by 1992-94. Industries intensive in unskilled labour and technology, on the other hand, were found to have a comparative disadvantage relative to Taiwan. This was evidenced by most unskilled labour-intensive industries losing their comparative advantage by 1992-94, while technology-intensive industries accounted for the largest share of industries with a consistent RCA index value below unity.

Figure 4.5: Australian Manufacturing Industries with a Comparative Disadvantage in Taiwan's Market, 1965-94



Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

Source: UN Trade Data, International Economic Databank, Australian National University.

4.4 Comparative Advantage in Tradeable Manufactures for Taiwan in the Australian Market

4.4.1 Taiwanese Comparative Advantage in Australia's Market for Unskilled Labour-Intensive Industries

The results from figure 4.6 show that despite unskilled labour-intensive manufactures accounting for the largest share of industries with a comparative advantage, a marked weakening was apparent by 1992-94. Ten industries saw a sharp fall in their RCA index ranking by 1992-94, including footwear (4th to 30th rank), plastic articles (5th to 16th rank), floor coverings and tapestry (18th to 66th rank), woven cotton fabrics (6th to 56th rank) and non-fur clothing (7th to 52nd rank). This led to the loss of comparative advantage for three of these industries (floor coverings and tapestry, woven cotton fabrics and non-fur clothing) by 1992-94. The remaining six industries (lace, ribbons and tulle, plumbing, heating and lighting equipment, non-cotton woven textiles, office supplies, glassware and glass) increased their RCA index rank, suggesting a shift in specialisation had taken place by 1992-94.[6]

Further evidence that Taiwan's comparative advantage in unskilled labour-intensive manufactures had weakened by 1992-94 can be seen by using Garnaut and Anderson's (1980:411) classification of 3-digit SITC codes. According to table 4.1, almost all of the unskilled labour-intensive industries, except for travel goods and handbags, identified by Garnaut and Anderson as having the lowest level of value added per person (category one), showed a loss of comparative advantage or decline in RCA index ranking. In other words, the industries within this category had become less labour-intensive. In contrast, industries with a relatively higher level of value added per worker (category two) were shown to have increased their RCA index ranking. Only three of these categories were shown to have had a fall in their RCA index ranking.

[6] Lee (1995) observed a similar trend within the Korean manufacturing sector over the same period. Mikic, Palac-McMiken and Ratnayake (1994:18) also observed this result for Taiwan in the New Zealand market.

Figure 4.6: Taiwanese Comparative Advantage in Australia's Market for Unskilled Labour-Intensive Manufactures, 1965-94

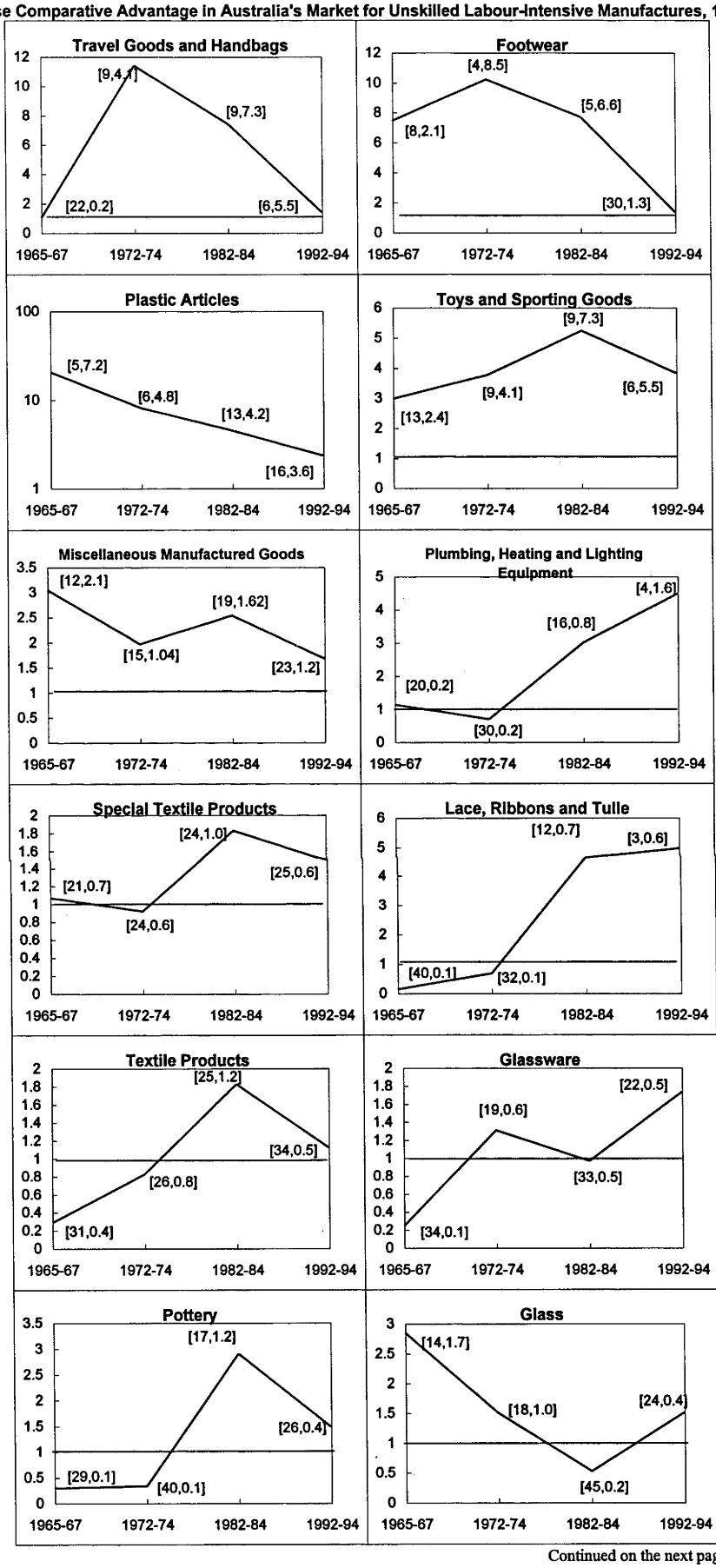


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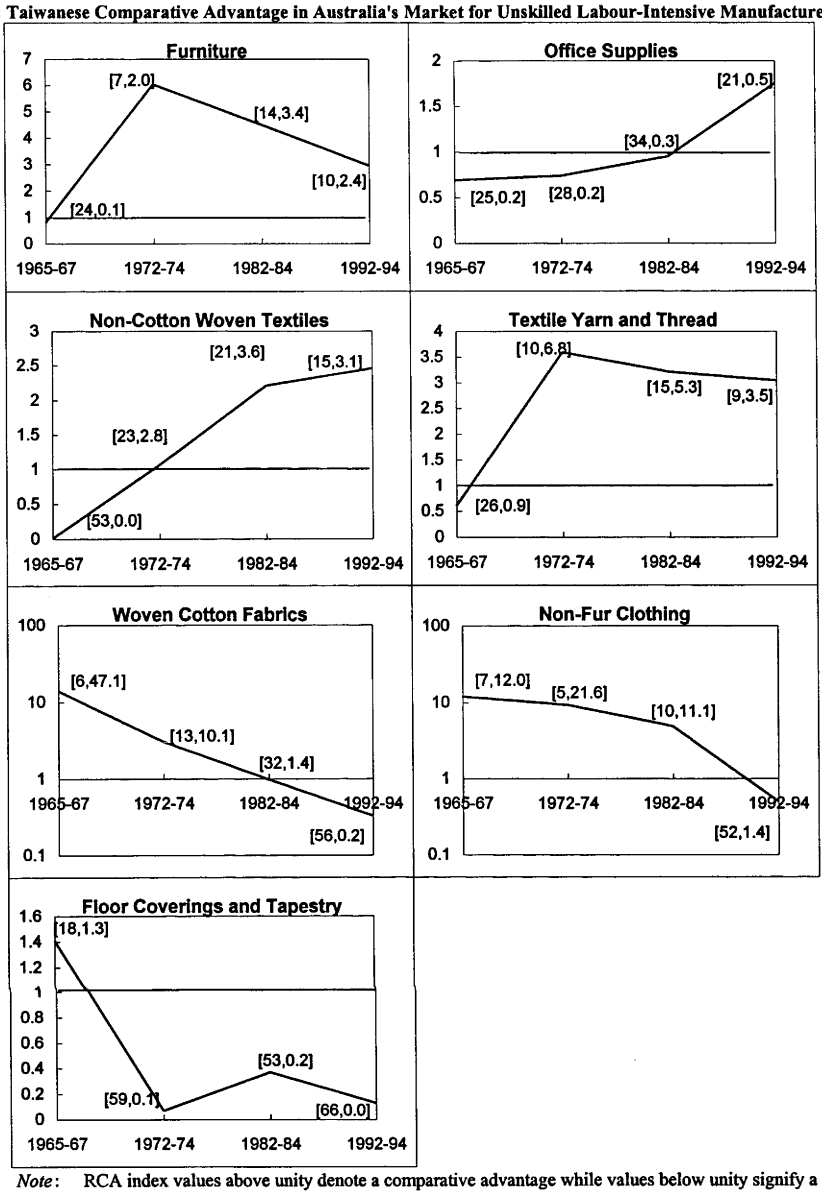
Figure 4.6: Taiwanese Comparative Advantage in Australia's Market for Unskilled Labour-Intensive Manufactures, 1965-94 (Continued)



Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

Source: UN trade data, International Economic Databank, Australian National University.

Table 4.1: Comparison of RCA Index Results with Garnaut and Anderson (1980) Value-Added Categories

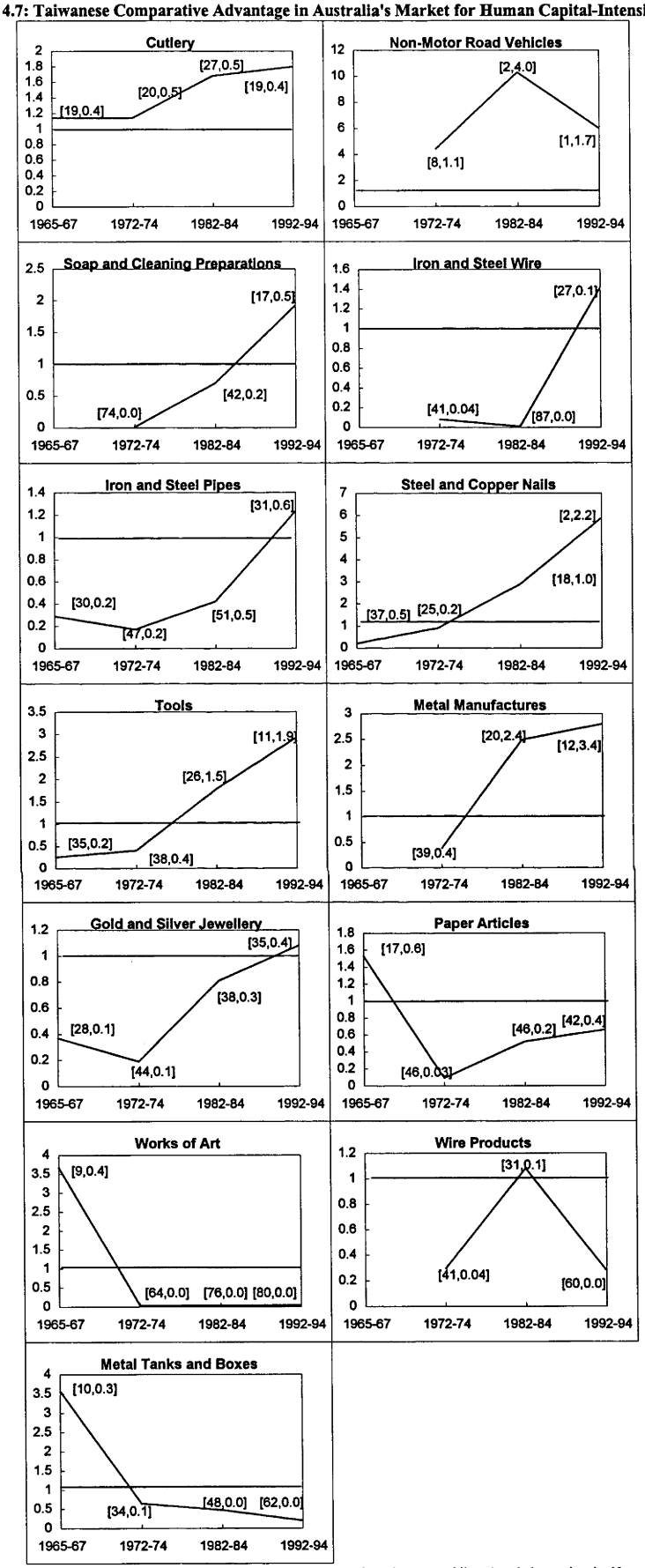
Category 1 (Lowest Value-Added Per Worker)	RCA Index Ranking between 1965-94
Woven Cotton Fabrics	⇑ 56th to 6th rank
Textile Products	⇓ 25th to 34th rank
Pottery	⇓ 17th to 26th rank
Travel Goods and Handbags	⇑ 22nd to 6th rank
Non-Fur Clothing	⇓ 5th to 52nd rank
Footwear	⇓ 4th to 30th rank
Category 2 (Relatively Higher Value-Added Per Worker)	
Textile Yarn and Thread	⇑ 26th to 9th rank
Non-Cotton Woven Textiles	⇑ 53rd to 15th rank
Lace, Ribbons and Tulle	⇑ 40th to 3rd rank
Special textile Products	⇓ 24th to 25th rank
Glass	⇑ 45th to 24th rank
Glassware	⇑ 34th to 22nd rank
Furniture	⇓ 7th to 10th rank
Toys and Sporting Goods	⇑ 13th to 6th rank
Office Supplies	⇑ 34th to 21st rank
Other Manufactures	⇓ 12th to 23rd rank

Sources: Categories from Garnaut , R. & Anderson, K. (1980), 'ASEAN Export Specialisation and the Evolution of Comparative Advantage in the Western Pacific Region', in *ASEAN in a Changing Pacific and World Economy*, ed. R. Garnaut, Canberra: ANU Press; RCA index ranking's from figure 4.6.

4.4.2 Taiwanese Comparative Advantage in Australia's Market for Human Capital-Intensive Industries

As a consequence of the patterns described above, Taiwan's comparative advantage shifted towards human capital-intensive manufactures by 1992-94. According to figure 4.7, eight of the 13 industries that had gained a comparative advantage in at least one of the four periods examined saw their RCA index value rise above unity by 1992-94. These industries were primarily metals-based, including iron and steel pipes and wire, soap and cleaning preparations, nails, tools, metal manufactures, gold and silver jewellery as well as paper articles.

Figure 4.7: Taiwanese Comparative Advantage in Australia's Market for Human Capital-Intensive Manufactures, 1965-1994



Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

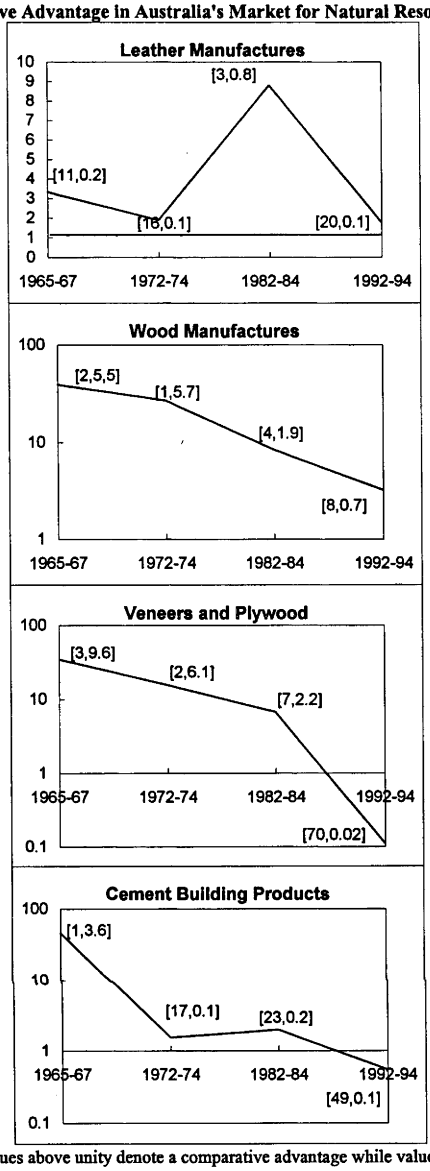
Source: UN trade data, International Economic Databank, Australian National University.

The shift in comparative advantage towards human capital-intensive manufactures was also supported by a reduced incidence of comparative advantage losses by 1992-94. Three industries, consisting of paper articles, art works and metal tanks and boxes, had lost a comparative advantage by 1972-74, compared to only one, wire products, by 1992-94. Non-motor road vehicles and cutlery revealed a comparative advantage for most of the period examined, with the former holding the highest RCA index ranking by 1992-94.

4.4.3 Taiwanese Comparative Advantage in Australia's Market for Natural Resource-Intensive Industries

According to figure 4.8, Taiwan developed a strong comparative disadvantage in natural resource-intensive manufactures. Only two natural resource-intensive industries, leather and wood manufactures, displayed an RCA index value above unity by 1992-94. During 1965-67, cement-building products, wood manufactures and veneers and plywood had a relatively high RCA index ranking. By 1972-74, this was only the case for wood manufactures and veneers and plywood, with cement building products declining to 17th highest rank. By 1982-84, the RCA index ranking for leather manufactures rose from 16th to 3rd highest position, while wood manufactures and veneers and plywood fell slightly to 4th and 7th positions respectively. By 1992-94, veneers and plywood and cement building products had lost their comparative advantage, falling to 70th and 49th rank respectively. Only wood and leather manufactures maintained a relatively high rank at 8th and 20th ranking respectively.

Figure 4.8: Taiwanese Comparative Advantage in Australia's Market for Natural Resource-Intensive Manufactures, 1965-94



Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

Source: UN trade data, International Economic Databank, Australian National University.

4.4.4 Taiwanese Comparative Advantage in Australia's Market for Technology-Intensive Industries

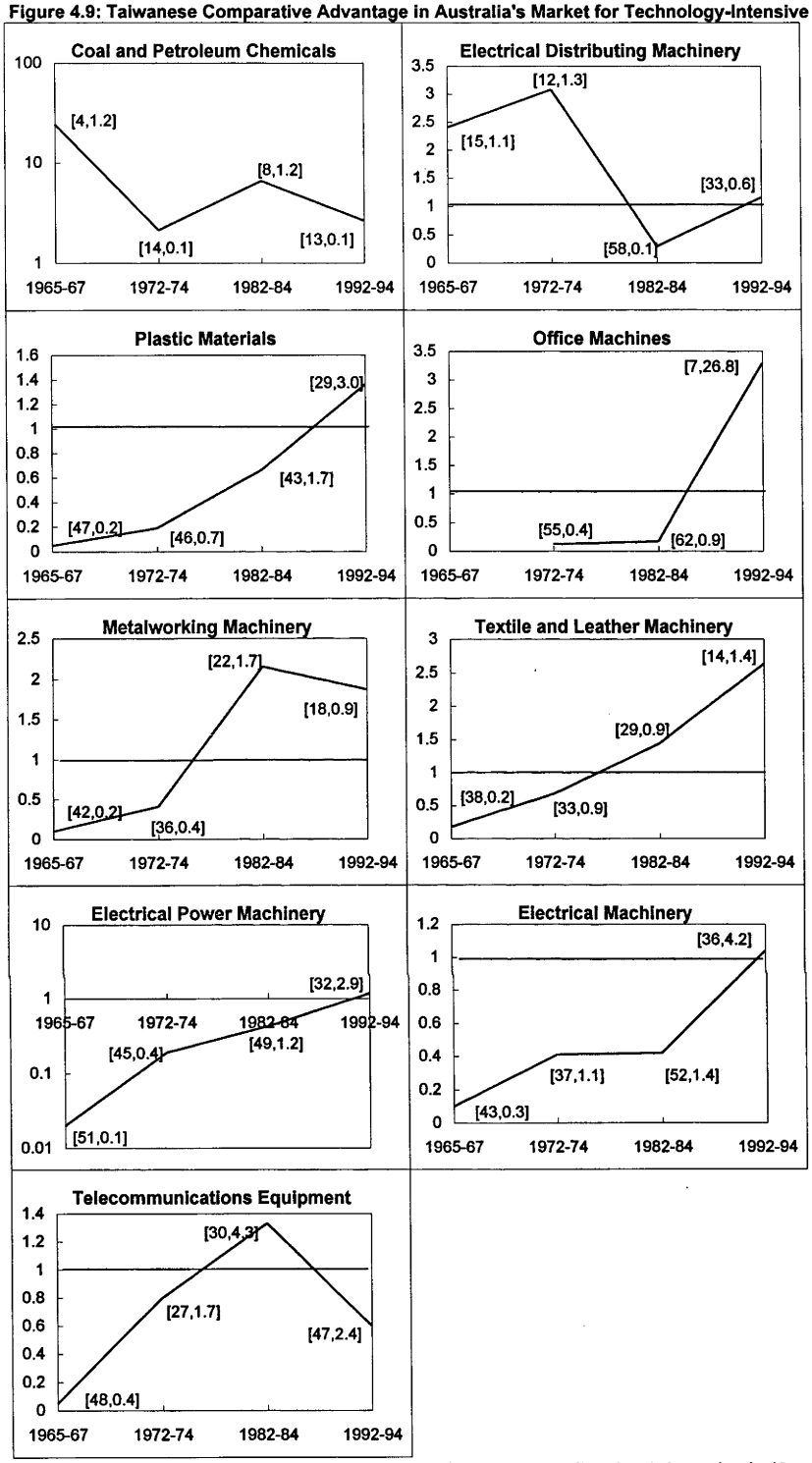
A relatively low number of technology-intensive manufactures had an RCA index value above unity by 1992-94, indicating that Taiwan had a comparative disadvantage in this factor. As figure 4.9 shows that while electrical distributing machinery, office machinery, plastic materials, electrical power machinery and electrical machinery had gained a comparative advantage by 1992-94, coal and petroleum chemicals and metalworking machinery saw declines in their RCA index values while telecommunications equipment lost a comparative advantage.

4.4.5 Taiwanese Manufacturing Industries in Australia's Market with a Comparative Disadvantage

Twelve manufacturing industries failed to gain a comparative advantage in the Australian market, as shown by figure 4.10. Six of the industries were technology-intensive, while human capital-intensive and natural resource-intensive manufactures each accounted for three industries. No unskilled labour-intensive industries had a RCA index value below unity in each of the four periods examined, confirming Taiwan's specialisation in unskilled labour-intensive manufactures.

In summary, Taiwan's comparative advantage in unskilled labour-intensive industries appeared to have weakened over the period examined, despite this factor accounting for the largest share of industries with RCA index values above unity. Lower RCA index values and increasing levels of value added per worker by 1992-94 provided evidence of this decline. Instead, comparative advantage appeared to be shifting towards human capital-intensive manufactures. A comparative disadvantage was evident for technology-intensive industries, with the highest share of RCA index values below unity, and natural resource-intensive manufactures, with the lowest share RCA index values above unity, by 1992-94.

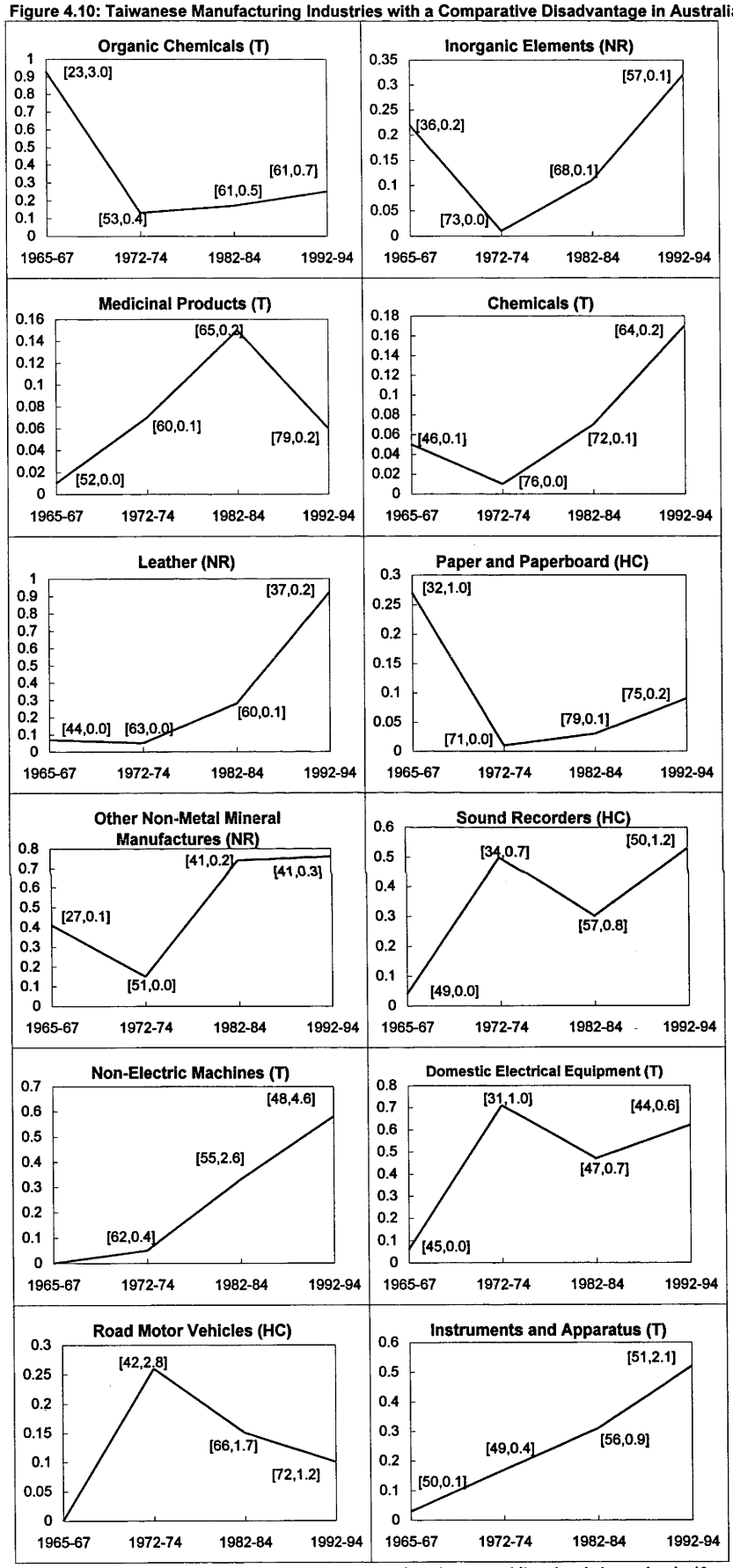
Figure 4.9: Taiwanese Comparative Advantage in Australia's Market for Technology-Intensive Manufactures, 1965-94



Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

Source: UN trade data, International Economic Databank, Australian National University.

Figure 4.10: Taiwanese Manufacturing Industries with a Comparative Disadvantage in Australia's Market, 1965-94



Note: RCA index values above unity denote a comparative advantage while values below unity signify a comparative disadvantage; Figures in parenthesis denote RCA index ranking and export share respectively.

Source: UN trade data, International Economic Databank, Australian National University.

4.5 The Character of Comparative Advantage between Australia and Taiwan

On the basis of results obtained in section 4.4, it is possible to examine whether Australian and Taiwanese comparative advantage had become increasingly complementarity or competitive between 1965-67 and 1992-94. If comparative advantage did become more competitive over this period, then both Australia and Taiwan would be expected to have a similar number of industries with an RCA index value above unity. Similarly, if comparative advantage were complementary, then only Australia would be expected to have RCA index values above unity for most industries.[7]

According to table 4.2, comparative advantage between Australia and Taiwan was largely complementary between 1965-67 and 1992-94. The number of industries where only Australia had an RCA index value above unity far exceeded those where both Australia and Taiwan had a comparative advantage. In terms of factor intensity, complementarity was highest for human capital-intensive industries, although technology-intensive and natural resource-intensive manufactures held the largest shares in 1982-84 (tables 4.3, 4.4, 4.5 and 4.6). As expected, competitiveness was highest for unskilled labour-intensive manufactures such as special textiles and textile products.

Table 4.2: Industries where Comparative Advantage was Complementary or Competitive between Australia and Taiwan, 1965-94

	1965-67	1972-74	1982-84	1992-94
RCA index value > 1 in Australia and Taiwan	6	12	10	6
RCA index value > 1 in Australia only	18	25	19	26

Source: Figures 4.1 to 4.10.

[7] This is not the only means for determining whether comparative advantage is complementary or competitive between countries. Chow and Kellman (1993:19) and Lutz (1987) have also used the rank correlation coefficient for this purpose.

Table 4.3: Industries where Australian Comparative Advantage was Complementary or Competitive with Taiwan, 1965-67

Industry	Complementary RCA Index Value > 1 in Australia only		Factor Intensity
Organic Chemicals	3.16	0.93	T
Tanning Dyes	4.12	..	HC
Pigments and Paints	9.49	..	HC
Medicinal Products	2.01	0.01	T
Explosives and Pyrotechnics	1.63	..	T
Lace, Ribbons and Tulle	6.42	0.15	UL
Textile Products	9.15	0.29	UL
Other Non-Metal Mineral Manufactures	2.29	0.41	NR
Iron and Steel Primary Forms	26.32	0.13	HC
Iron and Steel Shapes	3.62	..	HC
Iron and Steel Plates and Sheets	4.44	..	HC
Iron and Steel Hoops and Strips	6.03	..	HC
Railway Rails	88.06	..	HC
Iron and Steel Tubes and Pipes	2.26	0.29	HC
Agricultural Machinery	3.03	..	T
Metalworking Machinery	1.52	0.10	HC
Railway Vehicles	1.43	..	HC
Office Supplies	14.01	0.69	UL
Industry	Competitive RCA index value > 1		Factor Intensity
	Australia	Taiwan	
Floor Coverings and Tapestry	47.49	1.41	UL
Cement Building Materials	27.95	46.44	NR
Cutlery	2.08	1.14	HC
Special Textile Products	1.15	1.07	UL
Toys and Sporting Goods	12.69	2.99	UL
Works of Art	41.02	3.68	HC

Note: .. denotes industries where Taiwanese export volumes were not listed in the International Economic Databank as they were too low; HC = Human Capital-Intensive, NR = Natural Resource-Intensive, UL = Unskilled Labour-Intensive, T = Technology-Intensive.
Source: Figures 4.1 to 4.10.

Table 4.4: Industries where Australian Comparative Advantage was Complementary or Competitive with Taiwan, 1972-74

Industry	Complementary RCA Index Value > 1 in Australia Only		Factor Intensity
Inorganic Elements	10.73	0.01	NR
Other Inorganic Chemicals	1.54	0.02	T
Perfume and Cosmetics	56.06	0.01	HC
Tanned and Dressed Fur Skins	4.20	..	NR
Textile Products	7.36	0.83	UL
Clay Building Materials	5.95	0.02	NR
Other Non-Metal Mineral Manufactures	12.46	0.15	NR
Pottery	2.45	0.34	UL
Pig Iron	17.86	0.72	NR
Iron and Steel Primary Forms	7.56	..	HC
Iron and Steel Shapes	3.59	0.01	HC
Iron and Steel Plates and Sheets	2.06	0.01	HC
Iron and Steel Tubes and Pipes	1.06	0.17	HC
Metal Tanks and Boxes	4.49	0.64	HC
Non-Electric Wire Products	8.45	0.29	HC
Tools	2.34	0.40	HC
Metal Manufactures	1.06	0.38	HC
Agricultural Machinery	49.54	0.00	T
Machines for Special Industries	1.68	0.01	T
Domestic Electrical Equipment	4.48	0.71	HC
Railway Vehicles	1.19	0.14	HC
Road Motor Vehicles	1.47	0.26	HC
Fur Clothes	11.59	..	UL
Instruments and Apparatus	1.34	0.17	T
Gold, Silverware and Jewellery	2.32	0.19	HC
Industry	**Competitive RCA index value > 1 in Australia and Taiwan**		**Factor Intensity**
Explosives and Pyrotechnics	1.09	3.93	T
Leather Manufactures	1.89	3.17	NR
Rubber Articles	1.09	1.07	HC
Veneers and Plywood	15.53	4.73	NR
Wood Manufactures	26.89	3.17	NR
Non-Cotton Woven Textiles	1.06	1.08	UL
Cement Building Products	1.54	5.35	NR
Cutlery	1.14	48.53	HC
Furniture	6.04	44.04	UL
Non-fur Clothing	9.35	3.83	UL
Footwear	10.24	22.68	UL
Toys and Sporting Goods	3.77	1.48	UL

Note: .. denotes industries where Taiwanese export volumes were not listed in the International Economic Databank as they were too low; HC = Human Capital-Intensive, NR = Natural Resource-Intensive, UL = Unskilled Labour-Intensive, T = Technology-Intensive.

Sources: Figures 4.1 to 4.10.

Table 4.5: Industries where Australian Comparative Advantage was Complementary or Competitive with Taiwan, 1982-84

Industry	Complementary RCA Index Value > 1 in Australia Only		Factor Intensity
Inorganic Elements	4.78	0.11	NR
Medicinal Products	2.23	0.15	T
Perfume and Cosmetics	3.36	0.34	HC
Leather	1.24	0.28	NR
Tanned and Dressed Fur Skins	4.07	0.03	NR
Clay Building Materials	1.14	0.02	NR
Glass	2.40	0.53	UL
Glassware	1.01	0.97	UL
Pig Iron	10.63	0.13	NR
Iron and Steel Primary Forms	7.71	0.08	HC
Iron and Steel Plates and Sheets	2.23	0.94	HC
Iron and Steel Hoops and Strips	3.16	0.03	HC
Agricultural Machinery	6.40	0.06	T
Electrical Distributing Machinery	1.13	0.29	T
Fur Clothes	8.08	0.09	UL
Photo and Cinema Supplies	41.34	..	T
Developed Cinema Film	2.23	..	T
Office Supplies	3.31	0.95	UL
Works of Art	1.08	0.04	HC

Industry	Competitive RCA index value > 1 in Australia and Taiwan		Factor Intensity
Leather Manufactures	8.81	2.96	NR
Veneers and Plywood	6.68	15.54	NR
Textile Yarn and Thread	3.21	23.36	UL
Special Textile Products	1.83	7.28	UL
Non-Electric Wire Products	1.08	6.81	HC
Cutlery	1.68	19.41	HC
Metal Manufactures	2.49	1.22	HC
Furniture	4.50	1.88	UL
Footwear	7.73	14.10	UL
Toys and Sporting Goods	5.25	2.78	UL

Note: .. denotes industries where Taiwanese export volumes were not listed in the International Economic Databank as they were too low; HC = Human Capital-Intensive, NR = Natural Resource-Intensive, UL = Unskilled Labour-Intensive,
T = Technology-Intensive.
Sources: Figures 4.1 to 4.10.

Table 4.6: Industries where Australian Comparative Advantage was Complementary or Competitive with Taiwan, 1992-94

Industry	Complementary RCA Index Value > 1 in Australia Only		Factor Intensity
Inorganic Elements	4.01	0.32	NR
Tanning Dyes	1.76	..	HC
Pigments and Paints	6.00	0.12	HC
Medicinal Products	2.20	0.06	T
Perfume and Cosmetics	1.20	0.30	HC
Explosives and Pyrotechnics	1.23	0.20	T
Leather	16.00	0.92	NR
Tanned and Dressed Fur Skins	45.82	..	NR
Veneers and Plywood	1.08	0.11	NR
Paper and Paper-board	1.31	0.09	HC
Floor Coverings and Tapestry	1.05	0.13	UL
Clay Building Materials	1.41	0.62	NR
Other Non-Metal Mineral Manufactures	1.55	0.76	NR
Pearl, Precious and Semi-Precious Stones	1.43	0.08	NR
Pig Iron	2.15	0.00	NR
Iron and Steel Primary Forms	15.62	0.10	HC
Iron and Steel Shapes	3.51	0.35	HC
Iron and Steel Plates and Sheets	3.27	0.50	HC
Railway Rails	7.05	..	HC
Iron and Steel Castings	1.18	0.63	HC
Metal Structures and Parts	5.88	0.08	HC
Metal Tanks and Boxes	6.49	0.20	HC
Agricultural Machinery	1.94	0.10	T
Fur Clothing	6.00	..	UL
Photo and Cinema Supplies	6.96	0.08	T
Printed Matter	1.04	0.12	HC
Industry	**Competitive RCA index value > 1 in Australia and Taiwan**		**Factor Intensity**
Coal and Petroleum Chemicals	2.65	3.25	T
Soaps and Cleaning Materials	1.92	1.65	HC
Special Textile Products	1.50	2.00	UL
Textile Products	1.12	2.33	UL
Office Machines	3.29	1.26	UL
Gold, Silverware and Jewellery	1.08	1.01	HC

Note: .. denotes industries where Taiwanese export volumes were not listed in the International Economic Databank as they were too low; HC = Human Capital-Intensive, NR = Natural Resource-Intensive, UL = Unskilled Labour-Intensive, T = Technology-Intensive.
Sources: Figures 4.1 to 4.10.

4.6 Conclusion

Using RCA index values, this chapter examined the changing pattern of comparative advantage between Australia and Taiwan between 1965-67 and 1992-94. The overall results conformed well to the Hecksher-Ohlin predictions of comparative advantage patterns, although the present study did not intend to test this theory. Australia's comparative advantage was concentrated in human capital-intensive and natural resource-intensive manufactures. Not only did this reflect Australia's abundant natural resource endowment, but also Taiwan's demand for natural resource-intensive goods to fuel economic development. On the other hand, a comparative disadvantage was evident in unskilled labour-intensive and technology-intensive manufactures, as evidenced by the below unity RCA index values for the majority of these industries.

For Taiwan, unskilled labour-intensive manufactures had the highest share of industries with comparative advantage in the Australian market. However, increasing value added per worker and lower RCA index values indicated that comparative advantage in this factor had waned. Rising RCA index values for human capital-intensive indicated that comparative advantage had instead shifted towards this factor by 1992-94. A comparative disadvantage was found to exist in technology-intensive and natural resource-intensive industries. Technology-intensive industries accounted for the largest share of industries with a comparative disadvantage, while only two natural resource-intensive industries had an RCA index value above unity by 1992-94. This was presumably due to the decline in per capita natural resource endowment associated with rising incomes and manufacturing production.

The RCA index values also suggested that trade has been mutually beneficial between Australia and Taiwan between 1965 and 1994. This is evidenced by the fact that the majority of Australian industries with a comparative advantage (RCA index value above unity) were those where Taiwan had a comparative disadvantage (RCA index value below unity). Only in the case of unskilled labour-intensive

manufactures such as textiles was comparative advantage found to be competitive between Australia and Taiwan.

- CHAPTER FIVE -

COMPARATIVE LABOUR PRODUCTIVITY AND PRICE LEVELS: THE INDUSTRY-OF-ORIGIN APPROACH

5.1 Introduction

Thus far, comparative advantage in manufacturing between Australia and Taiwan has been assessed in terms of market share ratios or RCA index values. However, RCA index values are not the only means for assessing comparative advantage on a bilateral basis. Comparative advantage may also be gleaned from relative labour productivity and price levels, given that they have an important influence on relative competitiveness. This chapter will compare labour productivity and price levels between Australia and Taiwan from 1974 to 1995, using the industry-of-origin methodology described in chapter two. The chapter will begin by showing how the industry-of-origin methodology will be adapted to the Taiwan/Australia comparison, and the sources required for developing unit value ratios, or purchasing power parities, between the two countries. The specific problems encountered when creating unit value ratios between Australia and Taiwan will then be discussed, before examining comparative labour productivity and price levels. The penultimate section will briefly outline the possible reasons for differences in productivity levels between Australia and Taiwan. The chapter will then conclude and summarise the main points.

5.2 Methodology

For the present study, the 'maximalist' industry-of-origin methodology was adopted. As noted in chapter two, the 'maximalist' approach requires that a maximum number of identical products be matched between Australia and Taiwan. If production structures, product quality and product quantity specifications were identical, and product sales values and quantity information freely available, this process would be straightforward. Since this is not usually the case, it was only possible to match a

small share of total manufacturing output between each country.[1] According to table 5.1, only 72 products could be matched between Taiwan and Australia, accounting for 24 per cent and 16 per cent respectively of total manufacturing gross output in 1986 and 1986-87.[2] This meant that production had to be re-weighted in three successive stages to account for the share of output that could not be matched. With adjustments made for the Taiwan/Australia comparison, the aggregation process began with equation one and equation two as follows

(1) $$UVR_{i(m)}^{AT(A)} = \frac{\sum_{i=1}^{s} P_i^T * Q_i^A}{\sum_{i=1}^{s} P_i^A * Q_i^A}$$

using Australian quantity weights (Q_i^A) and

(2) $$UVR_{i(m)}^{AT(T)} = \frac{\sum_{i=1}^{s} P_i^T * Q_i^T}{\sum_{i=1}^{s} P_i^A * Q_i^T}$$

using Taiwan quantity weights (Q_i^T), where

$UVR_{i(m)}^{AT(A)}$ = Unit value ratio for converting industry (i) gross value added per person employed or hour worked in $NT into $A

$UVR_{i(m)}^{AT(T)}$ = Unit value ratio for converting industry (i) gross value added per person employed or hour worked in $A into $NT

P_i^T = Unit value of a Taiwan product

P_i^A = Unit value of an identical, or very similar, Australian product

The industry unit value ratios were then weighted by industry gross value added to obtain manufacturing branch unit value ratios, as shown by equation three and equation four. The results of these equations are displayed in table 5.2.

[1] This is a problem common to all industry-of-origin studies.

[2] Refer to appendix table A:1 for a description of the 72 product matches between Taiwan and Australia.

Table 5.1: Percentage of Gross Output Matched within Sample Manufacturing Industries, 1986-87 - Australia and Taiwan

Branch and Sample Industries	Taiwan 1986	Australia 1986-87	Geometric Average	Number of Matches per Industry	per Branch
1. FOOD, BEVERAGES AND TOBACCO					10
Dairy Products	57	60	58	4	
Fats and Oils	6	69	20	1	
Grain Mill Products	37	45	41	1	
Confectionery Products	100	100	100	1	
Prepared Animal Feeds	100	100	100	1	
Carbonated Beverages	100	100	100	1	
Tobacco and Tobacco Products	100	100	100	1	
2. TEXTILES, CLOTHING, LEATHER AND FOOTWEAR					22
Cotton Textiles	21	20	20	1	
Wool Textiles	95	50	69	1	
Synthetic Fiber Textiles	28	20	24	3	
Knitting Mills	70	70	70	8	
Woven Fabric Apparel	22	44	31	4	
Shoes	40	100	63	2	
Leather Tanning and Finishing	100	17	41	3	
3. WOOD, WOOD PRODUCTS, PAPER AND PAPER PRODUCTS			5		
Wood and Wood Products	62	6	19	2	
Paper and Paper-board	60	100	77	3	
4. CHEMICALS, CHEMICAL PRODUCTS, RUBBER AND PLASTIC PRODUCTS	14				
Chemical Products	88	41	60	2	
Basic Chemicals	32	59	43	11	
Rubber Tyres and Tubes	47	78	60	1	
5. BASIC AND FABRICATED METAL PRODUCTS					5
Iron and Steel Products	15	61	30	3	
Non-Ferrous Metal Products	22	59	36	2	
6. NON-METALLIC MINERAL PRODUCTS					
Cement and Cement Products	100	80	89	2	4
Bricks	34	97	57	2	
7. TRANSPORT EQUIPMENT AND OTHER MACHINERY					
Motor Vehicles and Equipment	7	80	23	1	12
Industrial Machinery	22	51	33	4	
Power Wires and Cables	100	100	100	2	
Electrical Appliances	29	89	50	5	
8. **TOTAL MANUFACTURING**	**24**	**16**	**20**	**72**	**72**

Notes: Sample industries represent industries where at least 20 per cent of total output was matched; Other manufacturing omitted since a product match could not be made within this branch.

Source: Directorate-General of Budget, Accounting and Statistics (1988), *The Report on 1986 Industrial and Commercial Census - Taiwan District Sample Survey Industrial Sector*, Vol. 34, Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan; and 1986-87 Manufacturing Commodities: Principal Articles Produced, Australia (ABS Cat. No. 8203.0), Canberra: AGPS.

Table 5.2: Manufacturing Branch Unit Value Ratios and Price Levels, Taiwan/Australia ($NT to the $A), 1986

Manufacturing Branch	PPP ($NT/$A) at Australian Quantity Weights	at Taiwanese Quantity Weights	Geometric Average	Comparative Price Level Taiwan Australia = 100)
1. Food, Beverages and Tobacco	47.0	69.5	57.2	161.0
2. Textiles, Clothing, Leather and Footwear	13.5	9.8	11.5	32.4
3. Wood, Wood Products, Paper and Paper Products	50.6	28.7	38.1	107.3
4. Chemicals, Chemical Products, Rubber and Plastic Products	20.3	15.5	17.7	49.9
5. Basic and Fabricated Metal Products	23.3	19.5	21.3	60.0
6. Non-Metallic Mineral Products	11.8	12.4	12.1	34.0
7. Transport Equipment and Other Machinery	18.1	3.0	7.4	20.9
8. Other Manufacturing	34.2	1.3	6.6	18.7
9. Total Manufacturing	30.4	9.4	16.9	47.6
1986 Exchange Rate	35.5			

Sources: The unit value ratio for food, beverages and tobacco is the weighted average of dairy products, fats and oils, grain mill products, confectionery products, prepared animal feeds, carbonated beverages, and tobacco and tobacco product unit value ratios; the unit value ratio for textiles, clothing, leather and footwear is the weighted average of cotton textiles, wool textiles, synthetic fibre textiles, knitting mills, woven fabric apparel, shoes and leather tanning, finishing and footwear unit value ratios; the unit value ratio for wood, wood products, paper and paper products is the weighted average of wood and wood products and paper and paper-board unit value ratios; the unit value ratio for chemicals, chemical products, rubber and plastic products is the weighted average of chemical products, basic chemicals and rubber tyres and tube unit value ratios; the unit value ratio for basic and fabricated metal products is the weighted average of iron and steel products and non-ferrous metal product unit value ratios; the unit value ratio for non-metallic mineral products is the weighted average of cement and cement products and brick unit value ratios; the unit value ratio for transport equipment, other machinery and equipment is the weighted average of motor vehicles and equipment, industrial machinery, power wires and cables and electrical appliance unit value ratios; the unit value ratio for other manufacturing is the weighted average of unit value ratios for all manufacturing branches, weighted with gross value added weights; the unit value ratio for total manufacturing is the unit value ratio of the 72 products matched in the present study and weighted with product quantity weights.

(3) $$UVR_k^{AT(T)} = \frac{\sum_{i=1}^{r} GVA_i^{T(\$NT)}}{\sum_{i=1}^{r} [GVA_i^{T((\$NT)} / UVR_i^{AT(T)}]}$$

(4) $$UVR_k^{AT(A)} = \frac{\sum_{i=1}^{r} [GVA_i^{A(\$A)} * UVR_i^{AT(A)}]}{\sum_{i=1}^{r} GVA_i^{A(\$A)}}$$

Where

$UVR_k^{AT(T)}$ = Unit value ratio for converting branch (k) gross value added per person employed or hour worked in $A into $NT

$UVR_k^{AT(A)}$ = Unit value ratio for converting branch (k) gross value added per person employed or hour worked in $NT into $A

$\sum_{i=1}^{r} GVA_i^{T(\$NT)}$ = Sum of industry gross value added for Taiwan in $NT

$\sum_{i=1}^{r} GVA_i^{A(\$A)}$ = Sum of industry gross value added for Australia in $A

$GVA_i^{T((\$NT)}$ = Taiwanese industry gross value added weights in $NT

$GVA_i^{A(\$A)}$ = Australian industry gross value added weights in $A

At the final stage, total manufacturing unit value ratios were created by weighting branch unit value ratios with branch gross value added in equation five and equation six, with the results again shown in table 5.2.

(5) $$UVR^{AT(T)} = \frac{\sum_{i=1}^{r} GVA_k^{T(\$NT)}}{\sum_{i=1}^{r} [GVA_k^{T((\$NT)} / UVR_k^{TA(T)}]}$$

(6) $$UVR^{AT(A)} = \frac{\sum_{i=1}^{r}[GVA_k^{A(\$A)} * UVR_k^{TA(A)}]}{\sum_{i=1}^{r} GVA_k^{A(\$A)}}$$

Where

$UVR^{AT(T)}$ = Unit value ratio for converting total manufacturing gross value added per person employed or hour worked in $A into $NT

$UVR^{AT(A)}$ = Unit value ratio for converting total manufacturing gross value added per person employed or hour worked in $NT into $A

$\sum_{j=1}^{r} GVA_k^{A(\$A)}$ = Sum of Australian branch gross value added in $A

$\sum_{j=1}^{r} GVA_k^{T(\$NT)}$ = Sum of Taiwanese branch gross value added in $NT

$GVA_k^{A(\$A)}$ = Australian branch gross value added weights in $A

$GVA_k^{T(\$NT)}$ = Taiwanese branch gross value added weights in $NT

Once gross value added per person employed or hour worked has been deflated to a common currency by the unit value ratios described above, it is necessary to obtain the geometric average to overcome the 'Gerchenkron' effect. Using Australia as the benchmark country, Taiwanese gross value added per person employed was converted into $A using equation seven.

(7) $$PROD_{LN}^{Fisher} = \sqrt{\frac{GVA^T / L^T}{(GVA^A * UVR^A) / L^A} * \frac{(GVA^T / UVR^T) / L^T}{GVA^A / L^A}}$$

Where

$PROD_{LN}^{Fisher}$ = Geometric average of gross value added per person employed in $NT and $A

GVA^T / L^T = Taiwanese gross value added per person employed in $NT

$(GVA^A * UVR^A) / L^A$ = Australian gross value added per person employed in $NT

$(GVA^T / UVR^T) / L^T$ = Taiwanese gross value added per person employed in $A

GVA^A / L^A = Australian gross value added per person employed in $A

To express Taiwanese gross value added per hour worked into $A using the Fisher geometric average, equation eight was used.

$$(8) \qquad PROD_{LH}^{Fisher} = \sqrt{\frac{GVA^T / (L_N^T * L_H^T)}{(GVA^A * UVR^A) / (L_N^A * L_H^A)} * \frac{(GVA^T / UVR^T) / (L_N^T * L_H^T)}{GVA^A / (L_N^A * L_H^A)}}$$

Where

$PROD_{LH}^{Fisher}$ = Geometric average of gross value added per hour worked in $NT and $A

$GVA^T / (L_N^T * L_H^T)$ = Taiwanese gross value added per hour worked in $NT

$(GVA^A * UVR^A) / (L_N^A * L_H^A)$ = Australian gross value added per hour worked in $NT

$GVA^T / UVR^T) / (L_N^T * L_H^T)$ = Taiwanese gross value added per hour worked in $A

$GVA^A / (L_N^A * L_H^A)$ = Australian gross value added per hour worked in $A

Since the methodology described above only allows Taiwanese gross value added per person employed or hour worked to be converted into $A for the 1986 benchmark year, it was necessary to extrapolate this result using time series. Equation nine and equation ten were used to extrapolate 1986 gross value added per person employed results to years between 1974 and 1995, while 1986 gross value added per hour worked was extrapolated for years between 1975 and 1992 using equation 11 and equation 12. The results of this methodology are displayed in table 5.3 and table 5.4 respectively.

$$(9) \qquad \frac{\frac{GVA_{t+1}^{T(A)}}{EMP_{t+1}^{T(A)}}}{\frac{GVA_{t+1}^{A(A)}}{EMP_{t+1}^{A(A)}}} = \frac{\frac{GVA_t^{T(A)}}{EMP_t^{T(A)}} * \frac{GVA_{t+1}^{T(T)}}{EMP_{t+1}^{T(T)}} \Big/ \frac{GVA_t^{T(T)}}{EMP_t^{T(T)}}}{\frac{GVA_t^{A(A)}}{EMP_t^{A(A)}} * \frac{GVA_{t+1}^{A(A)}}{EMP_{t+1}^{A(A)}} \Big/ \frac{GVA_t^{A(A)}}{EMP_t^{A(A)}}}$$

Table 5.3: Extrapolation of Value Added Per Person Employed by Manufacturing Branch, 1974-95
Taiwan/Australia, Australia = 100, per cent

Year	Food, Beverages and Tobacco	Textiles, Clothing, Leather and Footwear	Wood, Wood Products, Paper and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Basic and Fabricated Metals	Non-Metallic Mineral Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1974	8.4	41.8	13.8	61.3	34.9	35.2	54.0	69.6	42.6
1975	8.6	50.4	16.0	65.8	42.9	42.4	71.4	82.8	47.9
1976	11.3	55.7	15.1	66.6	56.0	50.3	70.3	84.8	52.5
1977	10.7	63.0	14.6	65.5	50.8	50.1	77.3	98.5	53.9
1978	10.8	69.9	17.8	68.8	65.3	55.6	86.9	97.0	58.8
1979	11.2	69.4	19.0	70.0	63.3	51.4	83.3	100.4	58.5
1980	10.9	84.5	17.8	66.7	65.6	54.1	84.6	111.9	56.6
1981	11.7	95.3	16.5	70.4	66.0	60.0	100.4	120.1	59.6
1982	12.5	101.8	15.4	73.2	65.8	52.3	97.6	127.8	59.4
1983	14.1	107.4	16.2	78.9	70.6	60.6	107.9	128.5	64.9
1984	13.8	110.5	16.8	79.4	72.9	57.2	108.5	175.2	65.0
1985	14.9	105	17.6	84.3	70.5	57.9	106.6	183.4	65.9
1986	15.3	120.7	20.9	109.6	78.4	62.0	120.7	150.3	76.1
1987	17.8	120.7	23.0	120.0	89.5	74.8	139.1	175.2	86.2
1988	17.9	134.8	22.0	125.2	87.3	84.2	147.7	183.4	86.3
1989	17.0	130.3	22.4	131.6	87.3	93.2	149.3	193.2	87.2
1990	18.1	148.2	23.6	157.9	96.0	108.3	158.4	207.6	94.6
1991	17.3	165.7	25.8	184.2	103.4	120.3	170.2	222.8	103.5
1992	14.0	183.2	22.5	196.5	110.2	132.2	160.8	223.6	96.1
1993	13.9	183.1	21.6	167.9	115.7	143.3	193.3	220.3	109.5
1994	13.6	179.2	20.5	166.0	118.2	138.6	225.8	218.6	109.4
1995	13.4	165.9	18.8	164.9	120.1	122.7	190.6	216.9	98.2

Sources: Benchmark unit value ratios from table 5.2; Australian gross value added and persons employed time series from appendix tables B:1 and C:1 respectively; Taiwanese gross value added and persons employed time series from appendix tables B:2 and C:2 respectively.

Table 5.4: Extrapolation of Value Added Per Hour Worked by Manufacturing Branch, 1975-92
Taiwan/Australia, Australia = 100, per cent

Year	Food, Beverages and Tobacco	Textiles, Clothing, Leather and Footwear	Wood, Wood Products, Paper and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Basic and Fabricated Metals	Non-Metallic Mineral Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1975	7.4	36.8	12.4	95.6	36.1	39.0	57.6	49.4	37.6
1976	9.3	43.5	11.5	101.5	46.3	47.8	56.4	74.5	41.3
1977	8.4	49.1	11.2	103.7	43.3	47.5	59.6	90.1	42.4
1978	8.6	57.8	13.4	73.8	55.6	50.8	70.2	105.6	45.9
1979	9.0	59.0	14.3	88.2	53.6	46.6	67.0	95.1	45.5
1980	9.6	68.7	13.5	82.1	54.8	48.3	68.6	88.7	44.7
1981	9.8	82.7	13.3	89.3	58.3	52.4	86.7	92.0	49.5
1982	10.7	85.8	12.1	93.7	57.2	44.6	84.9	77.8	48.8
1983	11.9	90.5	12.5	93.4	60.2	51.0	89.6	81.3	52.9
1984	12.0	91.2	12.9	80.8	70.7	49.7	92.1	74.9	53.2
1985	13.1	87.1	14.2	62.9	71.4	48.5	95.4	80.0	55.8
1986	13.5	100.0	16.5	96.0	67.5	51.9	102.1	90.1	63.5
1987	15.6	112.2	18.1	113.3	76.8	63.0	118.0	98.1	72.1
1988	16.2	105.5	18.4	106.4	78.6	75.3	129.8	105.3	75.0
1989	13.0	112.1	18.8	102.8	79.9	83.5	135.8	105.3	77.3
1990	13.1	124.3	19.5	160.7	83.0	90.9	136.8	109.6	80.4
1991	12.9	123.3	21.3	218.6	93.3	103.0	148.8	108.3	88.9
1992	13.9	154.1	19.0	192.7	98.8	110.1	143.3	113.5	82.3

Sources: Benchmark unit value ratios from table 5.2; Australian gross value added and total annual hours worked from appendix tables B:1 and D:1 respectively; Taiwanese gross value added and total annual hours time series from appendix tables B:2 and D:2 respectively.

(10)
$$\frac{\frac{GVA_{t+1}^{T(T)}}{EMP_{t+1}^{T(T)}}}{\frac{GVA_{t+1}^{A(T)}}{EMP_{t+1}^{A(T)}}} = \frac{\frac{GVA_{t}^{T(T)}}{EMP_{t}^{T(T)}} * \frac{GVA_{t+1}^{T(T)}}{EMP_{t+1}^{T(T)}} \Big/ \frac{GVA_{t}^{T(T)}}{EMP_{t}^{T(T)}}}{\frac{GVA_{t}^{A(T)}}{EMP_{t}^{A(T)}} * \frac{GVA_{t+1}^{A(A)}}{EMP_{t+1}^{A(A)}} \Big/ \frac{GVA_{t}^{A(A)}}{EMP_{t}^{A(A)}}}$$

Where

$\frac{GVA_{t+1}^{T(A)}}{EMP_{t+1}^{T(A)}}$ = Taiwanese gross value added per person employed in $A for years other than 1986

$\frac{GVA_{t}^{T(A)}}{EMP_{t}^{T(A)}}$ = Taiwanese gross value added per person employed in $A for 1986

$\frac{GVA_{t+1}^{T(T)}}{EMP_{t+1}^{T(T)}}$ = Taiwanese gross value added per person employed in $NT for years other than 1986

$\frac{GVA_{t+1}^{A(T)}}{EMP_{t+1}^{A(T)}}$ = Australian gross value added per person employed in $NT for years other than 1986

$\frac{GVA_{t}^{A(T)}}{EMP_{t}^{A(T)}}$ = Australian gross value added per person employed in $NT for 1986

$\frac{GVA_{t}^{T(T)}}{EMP_{t}^{T(T)}}$ = Taiwanese gross value added per person employed in $NT for 1986

$\frac{GVA_{t}^{A(A)}}{EMP_{t}^{A(A)}}$ = Australian gross value added per person employed in $A for 1986

$\frac{GVA_{t+1}^{A(A)}}{EMP_{t+1}^{A(A)}}$ = Australian gross value added per person employed in $A for years other than 1986

(11)
$$\frac{\frac{GVA_{t+1}^{T(A)}}{HRWKD_{t+1}^{T(A)}}}{\frac{GVA_{t+1}^{A(A)}}{HRWKD_{t+1}^{A(A)}}} = \frac{\frac{GVA_t^{T(A)}}{HRWKD_t^{T(A)}} * \frac{GVA_{t+1}^{T(T)}}{HRWKD_{t+1}^{T(T)}} \Big/ \frac{GVA_t^{T(T)}}{HRWKD_t^{T(T)}}}{\frac{GVA_t^{A(A)}}{HRWKD_t^{A(A)}} * \frac{GVA_{t+1}^{A(A)}}{HRWKD_{t+1}^{A(A)}} \Big/ \frac{GVA_t^{A(A)}}{HRWKD_t^{A(A)}}}$$

(12)
$$\frac{\frac{GVA_{t+1}^{T(T)}}{HRWKD_{t+1}^{T(T)}}}{\frac{GVA_{t+1}^{A(T)}}{HRWKD_{t+1}^{A(T)}}} = \frac{\frac{GVA_t^{T(T)}}{HRWKD_t^{T(T)}} * \frac{GVA_{t+1}^{T(T)}}{HRWKD_{t+1}^{T(T)}} \Big/ \frac{GVA_t^{T(T)}}{HRWKD_t^{T(T)}}}{\frac{GVA_t^{A(T)}}{HRWKD_t^{A(T)}} * \frac{GVA_{t+1}^{A(A)}}{HRWKD_{t+1}^{A(A)}} \Big/ \frac{GVA_t^{A(A)}}{HRWKD_t^{A(A)}}}$$

Where

$\frac{GVA_{t+1}^{T(A)}}{HRWKD_{t+1}^{T(A)}}$ = Taiwanese gross value added per hour worked in \$A for years other than 1986

$\frac{GVA_t^{T(A)}}{HRWKD_t^{T(A)}}$ = Taiwanese gross value added per hour worked in \$A for 1986

$\frac{GVA_{t+1}^{T(T)}}{HRWKD_{t+1}^{T(T)}}$ = Taiwanese gross value added per hour worked in \$NT for years other than 1986

$\frac{GVA_{t+1}^{A(T)}}{HRWKD_{t+1}^{A(T)}}$ = Australian gross value added per hour worked in \$NT for years other than 1986

$\frac{GVA_t^{A(T)}}{HRWKD_t^{A(T)}}$ = Australian gross value added per hour worked in \$NT for 1986

$\frac{GVA_t^{T(T)}}{HRWKD_t^{T(T)}}$ = Taiwanese gross value added per hour worked in \$NT for 1986

$\frac{GVA_t^{A(A)}}{HRWKD_t^{A(A)}}$ = Australian gross value added per hour worked in \$A for 1986

$\frac{GVA_{t+1}^{A(A)}}{HRWKD_{t+1}^{A(A)}}$ = Australian gross value added per hour worked in $A for years other than 1986

For relative price levels, a two-stage approach was required. The 1986 benchmark unit value ratios listed in table 5.2 were extrapolated for years between 1974 and 1995 using equation 13 and equation 14, with the benchmark and non-benchmark results shown in table 5.5. The extrapolated unit value ratios were then each divided by the market exchange rate to yield relative price levels in table 5.6.

(13) $$UVR_{t+1}^{TA(T)} = UVR_{t}^{TA(T)} * \frac{[P_{t+1}^{T(T)} / P_{t}^{T(T)}]}{[P_{t+1}^{A(A)} / P_{t}^{A(A)}]}$$

(14) $$UVR_{t+1}^{TA(A)} = UVR_{t}^{TA(A)} * \frac{[P_{t+1}^{T(T)} / P_{t}^{T(T)}]}{[P_{t+1}^{A(A)} / P_{t}^{A(A)}]}$$

Where

$P_{t+1}^{T(T)}$ = Manufacturing price index for Taiwan in $NT for years other than 1986

$P_{t+1}^{A(A)}$ = Manufacturing price index for Australia in $A for years other than 1986

$P_{t}^{T(T)}$ = Manufacturing price index for Taiwan in $NT for 1986

$P_{t}^{A(A)}$ = Manufacturing price index for Australia in $A for 1986

Table 5.5: Extrapolation of 1986 Benchmark Unit Value Ratios by Manufacturing Branch, 1974-95
Taiwan/Australia, Australia = 100

Year	Food, Beverages and Tobacco	Textiles, Clothing, Leather and Footwear	Wood, Wood Products, Paper and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Basic and Fabricated Metals	Non-Metallic Mineral Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1974	111.6	24.7	79.8	44.0	58.3	21.8	17.3	12.5	35
1975	108.7	19.6	60.4	34.5	38.6	19.8	13.5	12.7	28.7
1976	99.0	19.1	57.9	32.1	34.4	18.4	12.0	11.9	26.7
1977	93.9	17.4	55	29.6	33.8	17.1	11.2	11.0	25.2
1978	81.0	17.0	54.3	28.0	35.2	16.4	10.8	10.6	23.6
1979	70.6	16.9	61.1	30.3	35.9	16.4	10.4	10.0	23.2
1980	76.4	16.3	62.7	35.7	38.5	18.2	10.4	10.1	25.1
1981	84.2	15.9	58.5	34.3	31.9	17.4	9.4	10.2	24.6
1982	79.0	14.6	51.8	29.9	27.6	15.3	8.6	9.4	22.4
1983	71.7	13.9	48.6	27.5	25.9	14.7	8.1	8.6	21
1984	67.9	13.8	46.6	25.5	25.0	13.6	7.7	8.1	20
1985	60.5	12.5	41.2	23.1	23.2	12.7	7.1	7.6	18.4
1986	57.2	11.5	38.1	19.2	21.3	12.1	6.5	6.6	16.9
1987	51.7	10.6	36.3	17.1	18.1	11.1	5.7	5.6	15.2
1988	48.2	9.3	35.1	16.5	17.4	10.1	5.2	5	14.2
1989	45.9	8.6	33.9	14.9	17.2	9.6	4.8	4.6	13.2
1990	43.6	8.4	32.5	13.6	16.1	8.9	4.7	4.5	12.5
1991	42.7	8.6	31.9	13.0	16.9	8.8	4.6	4.5	12.6
1992	42.2	8.0	30	11.6	15.5	9.2	4.3	4.3	11.7
1993	42.2	7.9	31.0	11.3	16	9.3	4.5	4.5	11.9
1994	41.8	8.1	32.7	11.5	14.8	8.7	4.5	4.4	11.8
1995	45.2	8.1	35.3	12.6	16.2	8.6	4.5	4.6	12.4

Sources: Benchmark unit value ratios from table 5.2; Producer price indices from Yearbook Australia (ABS Cat. No. 1301.0), various issues, Canberra: AGPS for Australia; and the 1996 Taiwan Statistical Data book for Taiwan.

Table 5.6: Comparative Price Level by Manufacturing Branch, 1974-95, Taiwan/Australia, Australia = 100, per cent

Year	Food, Beverages and Tobacco	Textiles, Clothing, Leather and Footwear	Wood, Wood Products, Paper and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Basic and Fabricated Metals	Non-Metallic Mineral Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1974	293.7	64.9	210.1	115.7	153.4	57.3	45.5	33.0	92.1
1975	286.0	51.6	158.9	90.9	101.5	52.1	35.4	33.5	75.4
1976	260.5	50.1	152.3	84.5	90.6	48.3	31.6	31.3	70.3
1977	247.1	45.9	144.8	77.9	88.9	44.9	29.5	29.0	66.2
1978	225.1	47.3	151.0	77.8	97.7	45.5	30.0	29.4	65.7
1979	196.0	46.9	169.6	84.2	99.7	45.6	28.9	27.9	64.3
1980	212.1	45.4	174.1	99.1	107.0	50.5	28.9	28.1	69.7
1981	222.5	42.0	154.5	90.5	84.3	46.0	25.0	26.9	65.1
1982	198.0	36.7	129.7	75.0	69.2	38.4	21.5	23.5	56.2
1983	178.0	34.5	120.8	68.3	64.4	36.5	20.0	21.5	52.0
1984	172.1	35.1	118.1	64.6	63.2	34.4	19.5	20.6	50.7
1985	151.9	31.4	103.3	58.0	58.1	31.9	17.8	19.0	46.1
1986	161.0	32.4	107.3	54.0	60.0	34.0	18.4	18.7	47.6
1987	181.1	37.0	127.1	59.8	63.3	39.0	19.9	19.6	53.4
1988	171.1	33.1	124.6	58.7	61.9	36.0	18.3	17.9	50.4
1989	175.5	33.0	129.4	56.8	65.8	36.8	18.5	17.5	50.4
1990	160.7	31.1	119.8	50.1	59.5	32.8	17.4	16.7	46.2
1991	166.0	33.3	123.9	50.6	65.6	34.3	18.0	17.6	48.8
1992	166.0	31.4	118.2	45.6	61.2	36.3	17.1	17.1	46.1
1993	158.5	29.6	116.4	42.5	60.0	34.9	17.0	16.9	44.6
1994	159.4	31.0	124.6	43.8	56.5	33.0	17.0	16.8	45.1
1995	165.6	29.7	129.5	46.3	59.6	31.6	16.5	17.0	45.6

Sources: Benchmark unit value ratios from table 5.2; Producer price indices from Yearbook Australia (ABS Cat. No. 1301.0) for Australia; and the 1996 Taiwan Statistical Data book for Taiwan; Market exchange rates from IMF Financial Statistics, International Economic Databank, Australian National University.

5.3 Data Sources

5.3.1 Production Census

For Australia and Taiwan, the primary source for sales values and quantity at a product level was the census of production. For Taiwan, the *1986 Industrial and Commercial Census - Taiwan District Sample Survey, Industrial Sector* was used, since this was the most recent year consistent with the Australian census.[3] Gross output, gross value added and employment levels for 1986 at an industry, branch and total manufacturing level were also obtained from this source. For Australia, the *1986-87 Manufacturing Commodities: Principal Articles Produced, Australia* (ABS Cat. No. 8303.0) was used. Products were listed in far greater detail in the Australian census with approximately 3000 products listed, compared to only 504 products in the Taiwan survey. Gross value added, gross output and employment levels were obtained from the *1986-87 Manufacturing Industry: Details of Operations, Australia* (ABS Cat. No. 8203.0). The fact that this publication was derived from census data meant that unit value ratios from the Australian side were also consistent.

5.3.2 Time Series

To extrapolate labour productivity levels for years between 1974 and 1995, time series for GDP, employment and total annual hours worked was required. For Taiwan, branch and total manufacturing current price GDP data were obtained from the *1995 National Income in Taiwan Area of the Republic of China* and converted to 1984 prices using price indices in the *1996 Taiwan Statistical Data Book.*[4] The *Monthly Bulletin of Earnings and Productivity Statistics* was used to compute total

[3] A match between the *1993-94 Manufacturing Production, Australia: Principle Commodities Produced* (ABS Cat. No. 8365.0) and the *1991 Report on the Industrial and Commercial Census* was attempted, but it was found that manufacturing price indices had not been published at an industry level for both Australia and Taiwan, thereby preventing a deflation of 1993-94 industry unit value ratios to 1991 levels.

[4] This source only listed GDP figures at a branch and manufacturing level, thereby preventing an extrapolation of relative labour productivity at an industry level.

annual hours worked (total employment multiplied by hours worked) for Taiwanese manufacturing employees at a branch and total manufacturing level.

For Australia, GDP time series in 1984-85 prices were obtained from the Comparison of Output, Productivity and Purchasing Power in Australia and Asia (COPPAA) project. Employment figures were gleaned from *Manufacturing Industry: Details of Operations, Australia* for years between 1974-75 and 1989-90 and *Manufacturing Industry: Australia* (ABS Cat. No. 8221.0) between 1990-91 and 1995-96. For the number of hours worked by manufacturing workers, issues of *Distribution and Composition of Employee Earnings and Hours* (ABS Cat. No. 6306.0) were used for years between 1975-76 to 1992-93.[5]

5.4 Drawbacks with the Industry-of-Origin Approach

As was the case for RCA index values with government policies, the development of unit value ratios in the present study is subject to various distortions. These factors are, in order of importance, confidentiality rules, highly aggregated products and lack of detailed product descriptions (both being related to confidentiality rules), inconsistent product quality and quantities, and the prevalence of 'unique' products.

5.4.1 Confidentiality Rules

The existence of confidentiality rules meant that more than half of the 3000 products did not list sales values or the quantity produced. Such rules were a major impediment to matching products in the Taiwan census, particularly in terms of quantity information. The reason for this is that quantity information, particularly for a single firm or small number of firms, can be useful to competing firms in foreign countries. Inconsistency in quantity units for an aggregated product is another reason for the absence of quantity data.[6] These factors resulted in some industries appearing

[5] Both years represent the earliest and latest available data for average weekly hours worked by adult persons employed in full time non-managerial positions at a branch level. Issues for 1982-83 and 1984-85 were not available, requiring the use of 1981-82 and 1985-86 average hours worked as a proxy.

[6] For example, for a product group such as prepared and preserved vegetables, a quantity unit is not

to have a perfect match with Taiwanese industries in table 5.1 when, in most cases, it only reflected goods that were not classed as confidential.

5.4.2 High Level of Product Aggregation in the Taiwan Census

Relative to the Australian census, products in the Taiwan survey were highly aggregated. The Taiwan survey listed nearly 2500 products less than the Australian census. In many cases, it was necessary to group several Australian products to obtain a match with a single Taiwan product. For example, when matching 'mixed feedstuff' from the Taiwanese survey, it was necessary to aggregate products such as 'dog biscuits', 'poultry feeds', 'canned dog and cat foods', 'pig feeds' and 'cattle feeds' to create a match with the Australian census.

5.4.3 Lack of Product Descriptions

The failure of the Taiwan survey to include explanatory notes created a number of problems for the matching process. First, several products had abbreviated titles, such as 'P.E. sheets', 'G.I. plates' and 'E.G. plates', with no explanation of their meaning. Second, items such as carbonated beverages and tinned foods were expressed in terms of '1,000 dozen' or 'standard cases', without any reference to their weight or volume.[7] Third, the Taiwan census did not specify the number of manufacturing establishments included in the survey. As such, the present study had to assume that all manufacturing establishments were included in the Taiwan census.[8]

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listed because some items (e.g. pickles and chutney) may be classed in terms of kilolitres, while others (e.g. pickled olives) may be expressed in tonnes.

[7] While this problem was overcome in the case of carbonated beverages by using the *1986 Taiwan Statistical Yearbook* (which used metric tons), the standard case definition remained for tinned food.

[8] This is generally the approach taken by ICOP and COPPAA studies when explanatory notes are omitted.

5.4.4 Inconsistent Product Quality

A similar product description for products listed in the Taiwan and Australian census did not necessarily indicate consistent quality standards. This problem was exacerbated by the absence of a product coding system in the Taiwan survey. While this problem is not important when matching homogenous goods (for example, Portland cement), it may have been for heterogenous goods such as machinery, electronics and transport equipment. Since most of the product matches in the present study were for standardised goods, quality differences were unlikely to have had an important influence on unit value ratios. Moreover, a product match was not attempted in cases where product quality was likely to be inconsistent, thereby maximising the potential accuracy of unit value ratios.

5.4.5 Inconsistent Quantity Units

Before a product could be matched between Australia and Taiwan, it had to be expressed in terms of a common quantity unit. In most cases, this was not problematic since the standard unit in the Taiwan survey was metric tons, while Australian products were measured mainly in terms of tonnes. However, products denoted in cubic metres, (such as acyclic hydrocarbons in the Australian census), could not be matched with a counterpart in Taiwan since it was denoted in tons. Moreover, a conversion to metric tonnes for products such as shampoo, milk and fabric softener expressed in kilolitres required an assumption that they had the same density as water. The tendency for the Taiwan survey to express some products (such as sporting goods and toys) in terms of New Taiwan dollars also prevented a match with Australian products.

5.4.6 'Unique' Products

The Taiwan census listed a number of products that did not have an Australian counterpart. 'Monosodium glutamate', 'canned bamboo shoots', 'bamboo products'

and 'roasted eel' are examples of products regarded as 'unique', in the sense that they were not produced in Australia. In any case, this was not a major impediment to the matching process, since country-specific products formed only a small share of Taiwan's products.

5.5 Results

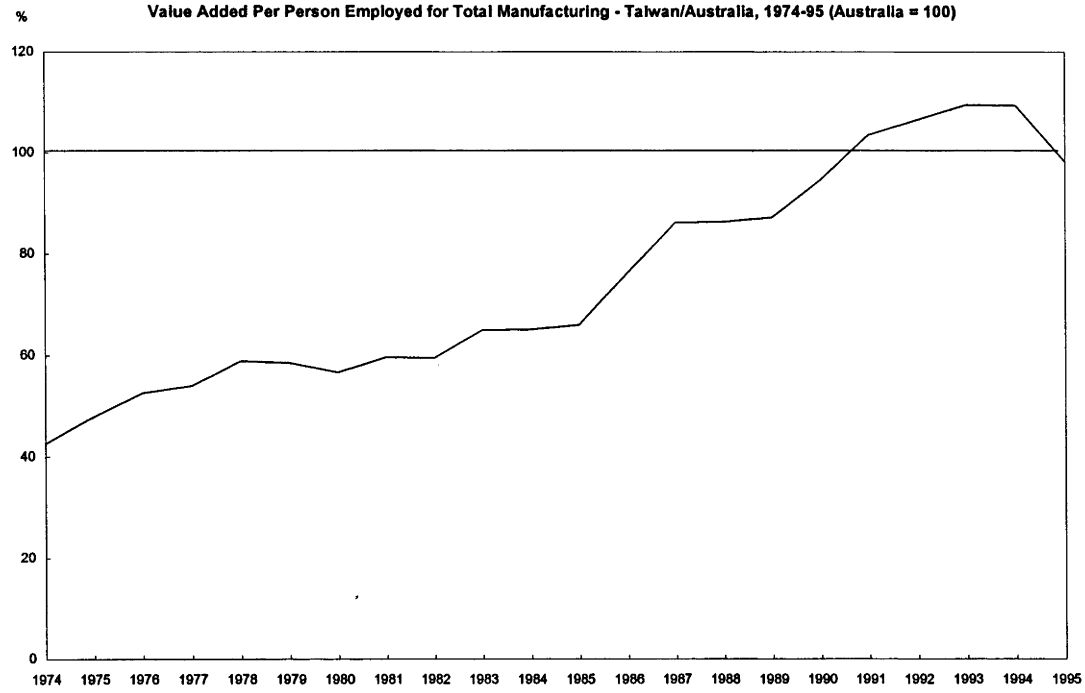
Notwithstanding the various problems described above, the unit value ratios developed in the present study were considered to be more accurate in converting Taiwanese labour productivity levels to $A than the market exchange rate. The results of this conversion will now be described and presented in graphical form so that long-term trends can become discernible. Since Australia was chosen as the benchmark country, figures above or below 100 indicate that Taiwanese labour productivity and price levels are higher or lower than their Australian counterpart. As the purpose of this chapter is to infer comparative advantage, values above or below 100 are also considered to represent a comparative advantage or disadvantage for Taiwan relative to Australia.

5.5.1 Gross Value Added Per Person Employed

A pattern of rapid catch-up, convergence and decline was apparent for Taiwan's labour productivity levels relative to Australia between 1974 and 1995 at a total manufacturing level.[9] Figure 5.1 shows that in 1974, Taiwanese gross value added per person was less than half of the Australian level at 43 per cent. By 1993, Taiwan's labour productivity had more than doubled, exceeding Australian levels by almost 10 per cent. Declines were observed in both 1994 and 1995, with labour productivity falling below Australia levels to 98 per cent. However, more evidence would be required beyond a two-year period to conclude that labour productivity in Taiwan did fall relative to Australia.

[9] The catch-up rate is defined as the rate at which Taiwan has gained on Australian labour productivity levels.

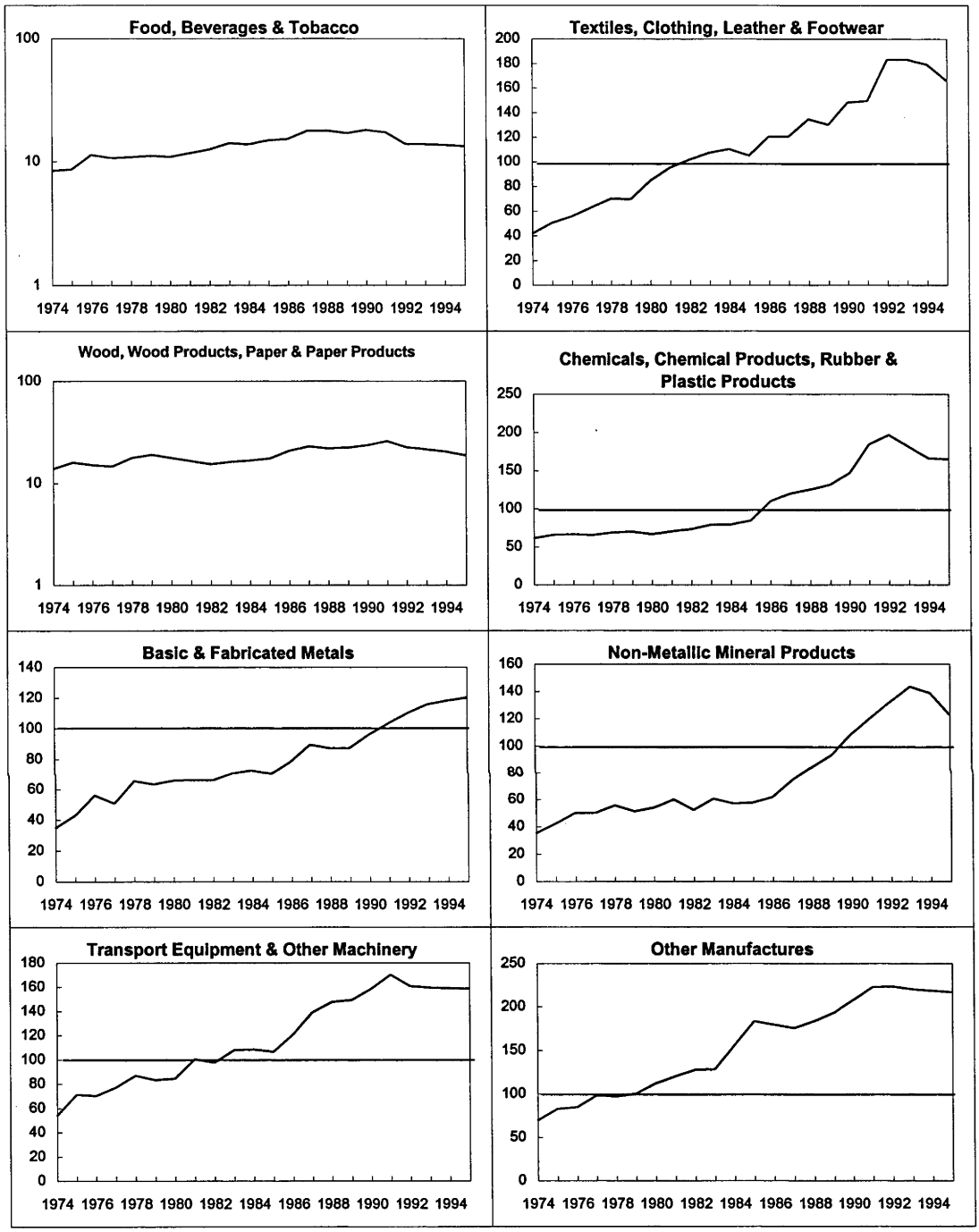
Figure 5.1
Value Added Per Person Employed for Total Manufacturing - Taiwan/Australia, 1974-95 (Australia = 100)



Source: Table 5.3.

Rapid catch-up with Australian productivity levels was also observed in figure 5.2 in each of Taiwan's manufacturing branches. This was with the exception of food, beverages and tobacco and wood, wood products, paper and paper products, where gross value added per person employed averaged only 20 per cent of Australian levels. Four branches were shown to have more than doubled their labour productivity levels relative to Australia over this period. Other manufacturing (147 per cent), textiles, clothing, leather and footwear (124 per cent), transport and other machinery (105 per cent), and chemicals, chemical products, rubber and plastic products (104 per cent).

Figure 5.2
Gross Value Added per Person Employed by Manufacturing Branch
Taiwan/Australia, 1975-1995 (Australia = 100) per cent



Note: Levels above 100 indicate that Taiwan has a comparative advantage relative to Australia.
Levels below 100 denote a comparative disadvantage for Taiwan relative to Australia.

Source: Table 5.5.

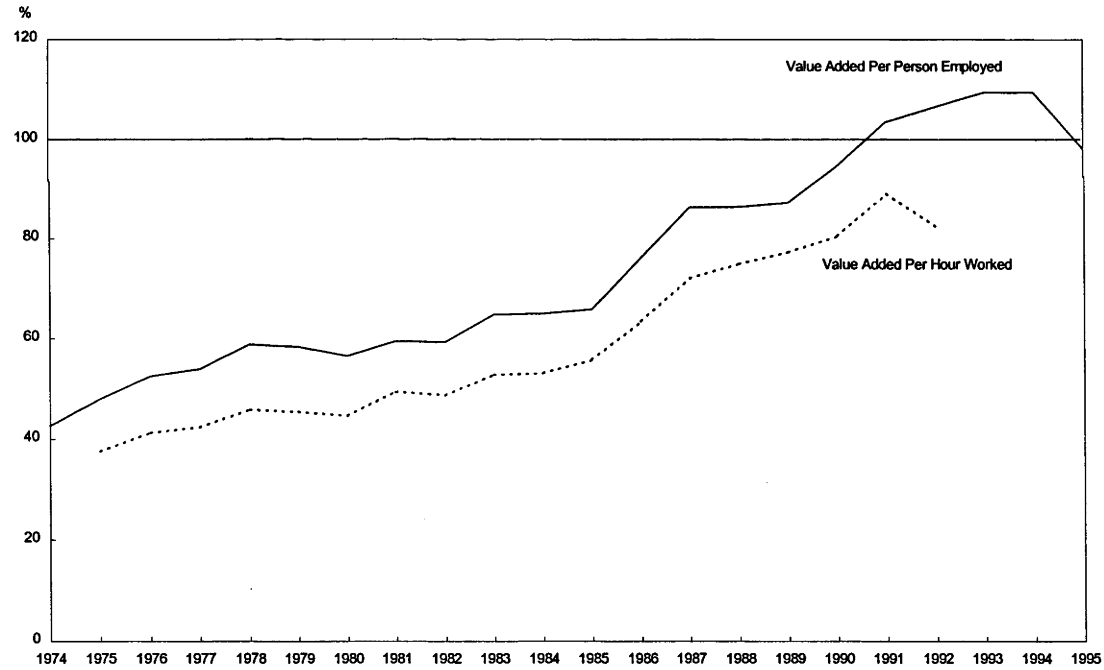
Almost all of Taiwan's manufacturing branches had surpassed Australian labour productivity levels during the 1980s. Labour productivity in textiles, clothing, leather and footwear, transport equipment and other machinery, and chemicals, chemical products, rubber and plastics had all surpassed Australian levels during the early to mid-1980s, while this was the case for basic and fabricated metals and non-metallic mineral products in the late 1980s. The only exception was for other manufactures, which had achieved a relatively higher labour productivity level after the mid-1970s. As was the case at a total manufacturing level, labour productivity in these industries (excluding basic and fabricated metals) had peaked in the early 1990s before declining in 1994 and 1995. Again, further evidence would be required to determine whether this represented the beginning of a long-term trend downwards.

Translated into comparative advantage, the above trends suggest that Taiwan had gained a comparative advantage in all branches except for food, beverages and tobacco and wood, wood products, paper and paper products by the mid-1990s. This was a marked turnaround from the 1970s, where no manufacturing branches were shown to have a comparative advantage relative to Australia. At a total manufacturing level, it would appear that this was only the case in 1991, 1993 and 1994, as labour productivity levels exceeded 100 only during these years.

5.5.2 Gross Value Added Per Hour Worked

Despite gross value added per person employed providing a good approximation of labour productivity levels, it is not necessarily the most accurate. While output levels in Taiwan are indeed higher than in Australia, employees in Taiwan generally worked longer hours, particularly through greater use of overtime, to produce this output.[10] This meant that output in Taiwan is produced with greater labour input relative to Australia. Hence, gross value added per hour worked is likely to be a more accurate indicator of Taiwan labour productivity levels relative to Australia, than gross value added per person employed.

Figure 5.3: Value Added Per Person Employed and Hour Worked - Taiwan/Australia, 1974-95 (Australia = 100)



Source: Tables 5.3 and 5.4.

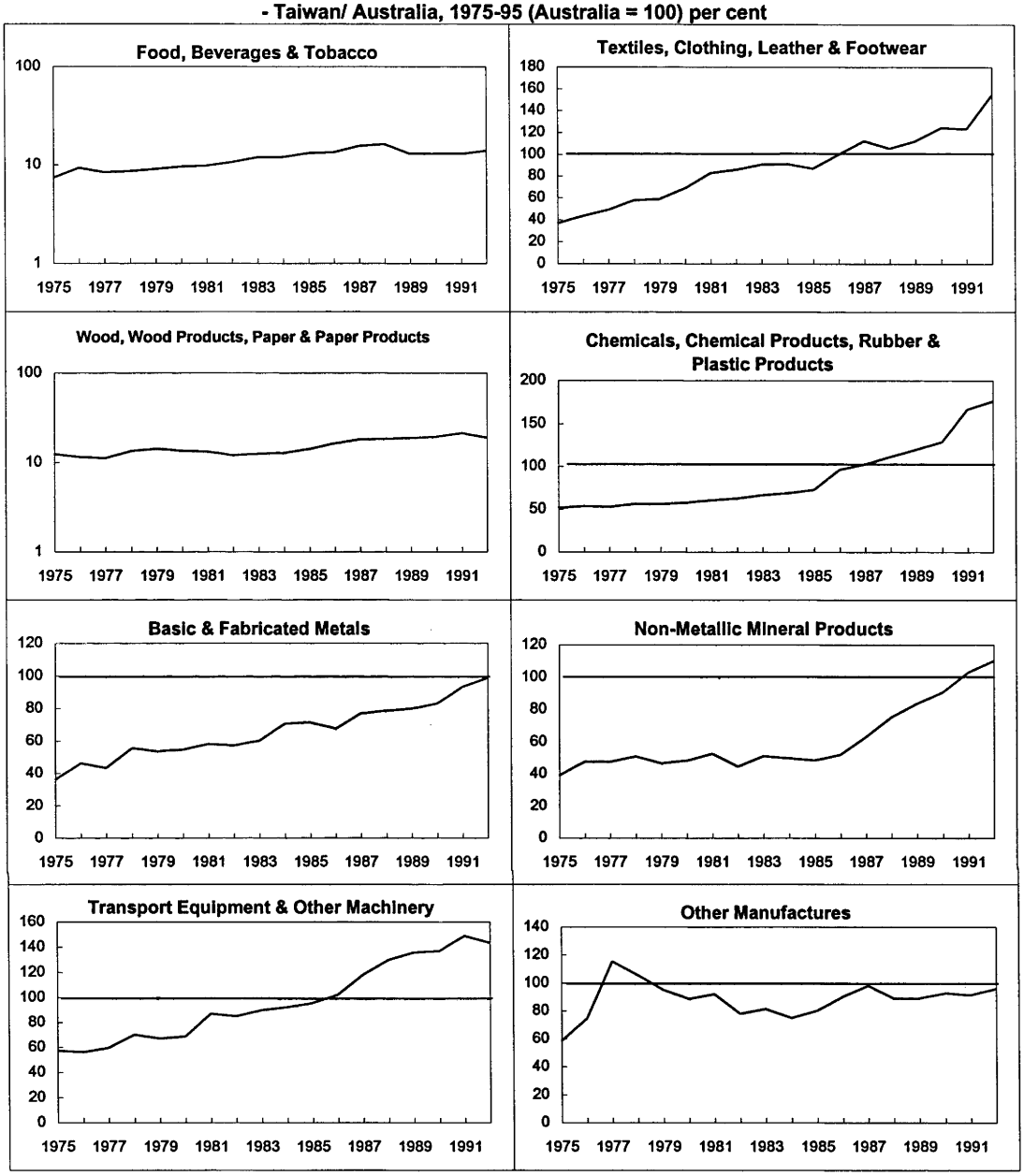
[10] Taiwan manufacturing employees, on average, worked 2,500 hours per annum between 1975 and 1992, compared to 2,100 hours by Australian workers.

As expected, Taiwan's labour productivity levels relative to Australia were lower when measured in terms of gross value added per hour worked. Figure 5.3 showed that labour productivity levels for Taiwan relative to Australia fell, on average, by 12 per cent between 1975 and 1992 when the longer hours worked by Taiwanese manufacturing employees were considered. Trends in gross value added per hour worked confirmed the rapid catch-up between 1975 and 1994, with the productivity gap narrowing from 38 per cent to 88 per cent of Australian levels over this period. Unlike gross value added per person employed, gross value added per hour worked trends had yet to surpass Australian labour productivity levels by 1994.

Figure 5.4 shows the trends in labour productivity for the eight manufacturing branches. As was the case with gross value added per person employed, rapid catch-up in gross value added per hour worked was observed for most manufacturing branches. The highest increase in relative labour productivity levels between 1975 and 1992 were observed for textiles, clothing, leather and footwear (117 per cent), chemicals, chemical products, rubber and plastic products (97 per cent) and transport equipment and other machinery (86 per cent). The lowest increase in relative labour productivity levels, on the other hand, was revealed in food, beverages and tobacco and wood, wood products, paper and paper products with seven per cent each.

Accounting for longer working hours suggests there was a delay in Taiwanese manufacturing branches gaining a comparative advantage relative to Australia. Textiles, clothing, leather and footwear and transport equipment and other machinery did not gain a comparative advantage relative to Australia until 1986, in 1987 for chemicals, chemical products, rubber and plastic products, in 1988 for other manufactures and 1991 for non-metallic mineral products. At no time did basic and fabricated metal products reveal a comparative advantage relative to Australia, which was shown with gross value added per person employed trends. The strong comparative disadvantage in food, beverages and tobacco and wood, wood products, paper and paper products remained unchanged when gross value added per hour worked was used as a definition of labour productivity.

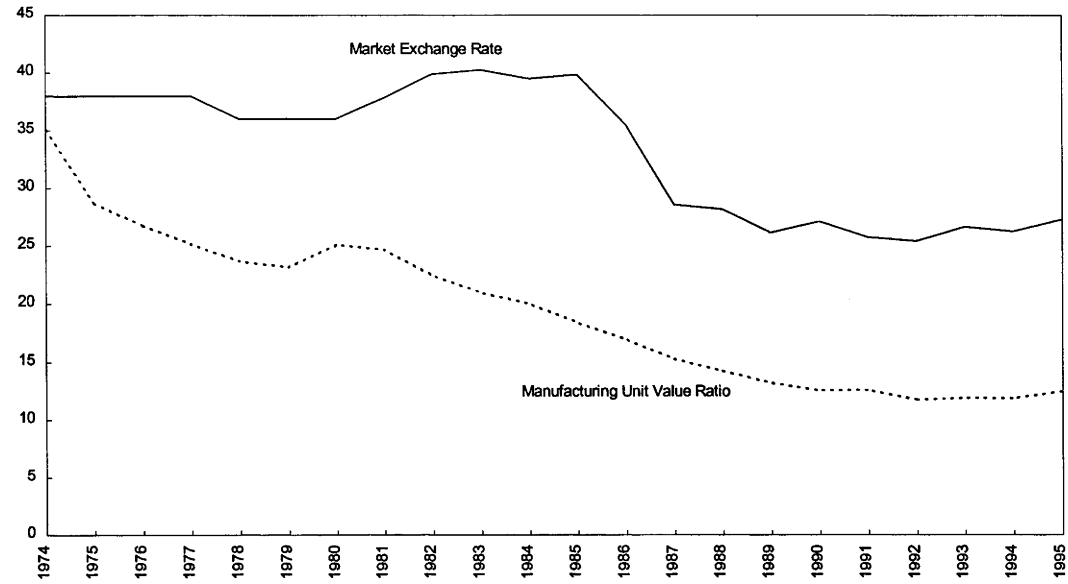
Figure 5.4
Gross Value Added per Hour Worked by Manufacturing Branch - Taiwan/ Australia, 1975-95 (Australia = 100) per cent



Note: Levels above 100 indicate that Taiwan has a comparative advantage relative to Australia.
Levels below 100 denote a comparative disadvantage for Taiwan relative to Australia.

Source: Table 5.4.

Figure 5.5 Manufacturing Unit Value Ratio and Market Exchange Rate, Taiwan/Australia, 1974-95

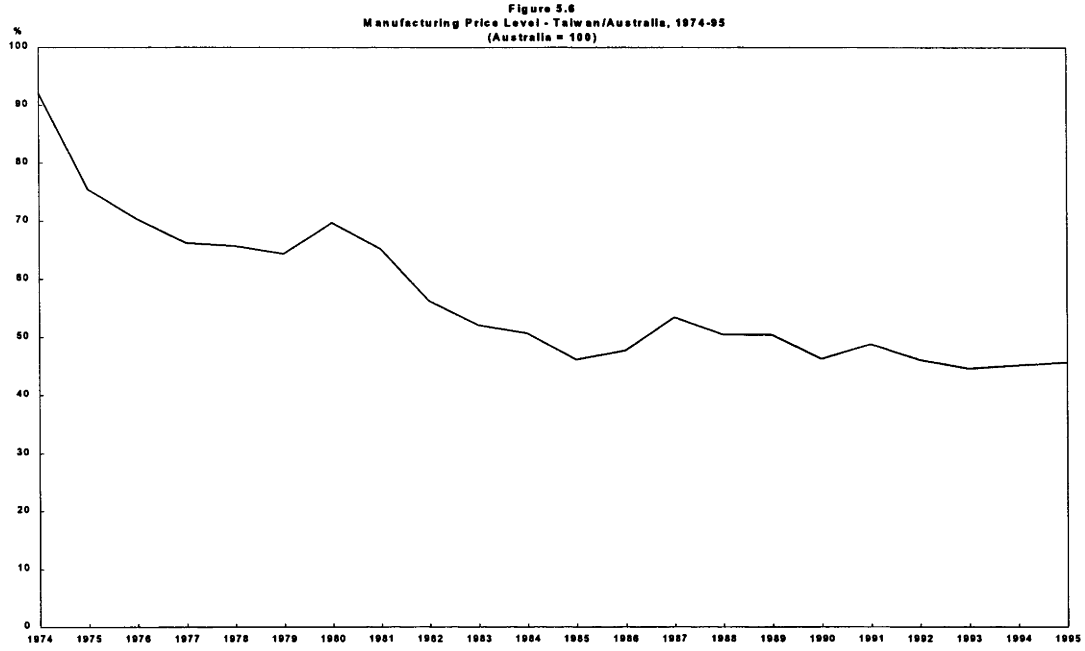


Source: Table 5.5 and IMF Financial Statistics, International Economic Databank, Australian National University.

5.5.3 Relative Price Levels

Manufacturing unit value ratios consistently remained below the market exchange rate over the period examined, as shown by figure 5.5.[11] This resulted in Taiwan having a lower manufacturing price level relative to Australia. According to figure 5.6, relative price levels in Taiwan fell to less than half of the Australian level, from 92 per cent in 1974 to 45 per cent in 1993. A slight increase in relative prices occurred in 1994 and 1995, although, as was the case for trends in gross value added per person employed, more evidence would be required to conclude that this represented the end of the long term decline in Taiwan's price levels relative to Australia.

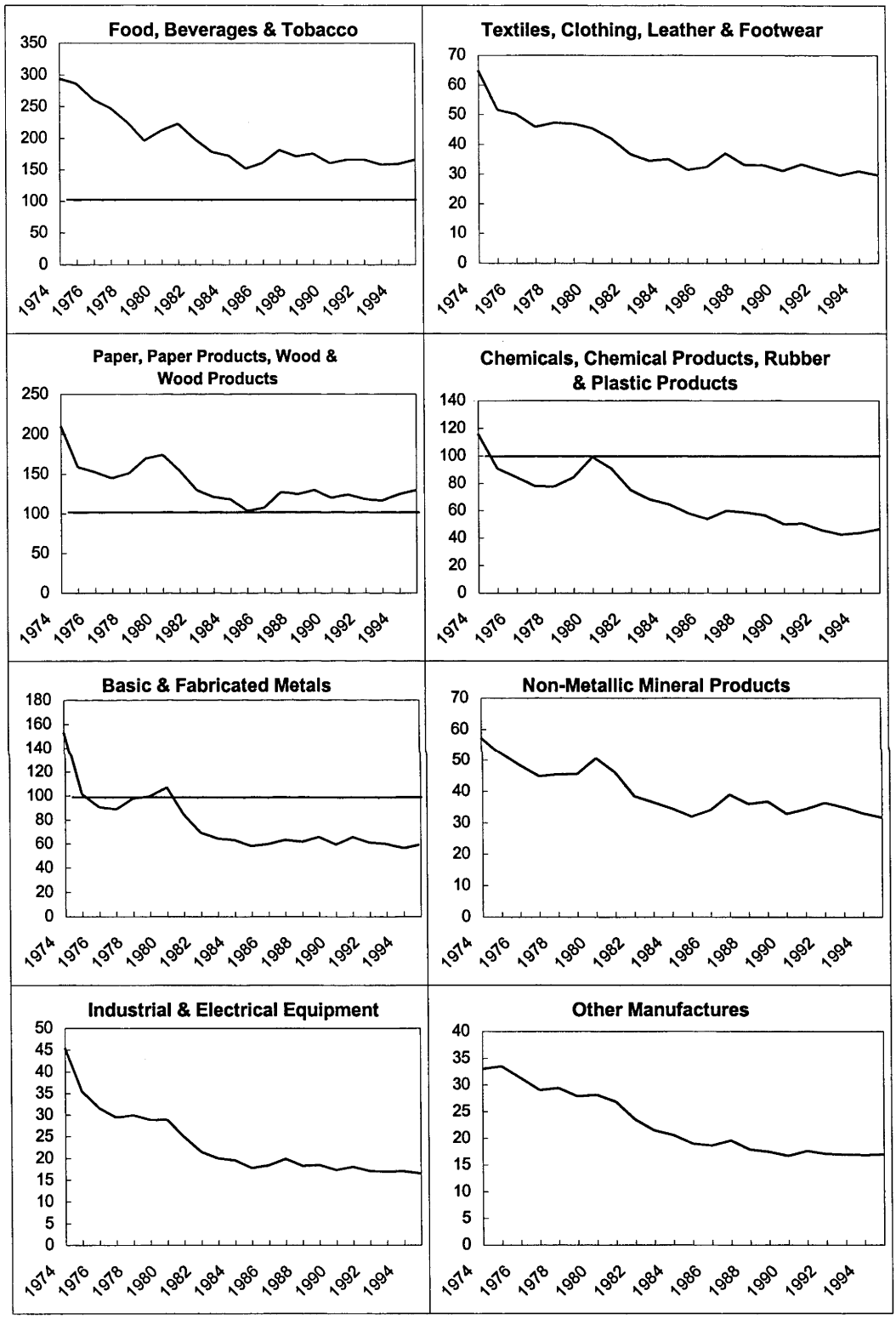
[11] This meant that Taiwan's labour productivity levels relative to Australia would have been undervalued had the market exchange rate had been used instead of unit value ratios.



Source: Table 5.8.

The decline in Taiwan's price levels relative to Australia was reflected not only at a total manufacturing level but also at a branch level. Referring to figure 5.7, relative prices fell in each of the eight manufacturing branches as Taiwan increased labour productivity levels relative to Australia. This was even the case for food, beverages and tobacco and wood, wood products, paper and paper products, although Taiwanese prices remained above Australian levels for both branches over the 21-year period. This is most likely attributed to Taiwan's low natural resource endowment relative to Australia. Taiwan was shown to be most competitive in industrial and electrical equipment and other manufacturing, each falling to only 17 per cent of Australian price levels in 1995. Other branches where prices were substantially lower than Australian levels in 1995 were textiles, clothing, leather and footwear (30 per cent), non-metallic mineral products (32 per cent), and chemicals, chemical products, rubber and plastic goods (46 per cent).

Figure 5.7 Extrapolated Price Levels by Manufacturing Branch - Taiwan/Australia, 1974-95 (Australia = 100) per cent



Source: Table 5.8.

The price falls reflect a relatively higher rate of labour productivity, where the same amount of output can be produced at a relatively lower price (OECD 1994:135).[12] A comparison of relative price levels with gross value added per person employed and hour worked results shows that industries with the highest increases in labour productivity levels were also those shown to have the lowest price levels relative to Australia. This was the case for textiles, clothing, leather and footwear, transport equipment and other machinery, other manufacturing and chemicals, chemical products, rubber and plastic products.

5.6 Explanation of Labour Productivity Differentials

While it was clear from the previous sections that a rapid convergence in productivity levels took place between Australia and Taiwan from 1974 to 1995, the reasons for this result were not always obvious. In the case of food, beverages and tobacco and wood, wood products, paper and paper products, resource-rich countries such as Australia will always have a higher level of output per labour input relative to resource-poor countries such as Taiwan. But for other branches, other factors may have been more important. While a comprehensive analysis of the reasons underlying Taiwan's rapid catch-up in labour productivity levels relative to Australia lies beyond the scope of this thesis, this section will address two possible factors, relatively stronger productivity growth in Australia or Taiwan and differences in employment structures between the two countries.

[12] Clark, Geer and Underhill (1996:23) refer to this phenomenon as the 'productivity-price paradox'.

Table 5.7: Labour Productivity by Manufacturing Branch - Taiwan/Australia 1974-95, 1986 = 100

Manufacturing Branch	Taiwan	Australia	Taiwan/ Australia
Food, Beverages and Tobacco	133.3	151.9	87.8
Textiles, Clothing, Leather and Footwear	156.0	112.6	138.5
Wood, Wood Products, Paper and Paper Products	89.2	113.9	78.5
Chemicals, Chemical Products, Rubber and Plastic Products	216.5	154.3	140.3
Non-Metallic Mineral Products	222.2	113.0	196.6
Basic and Fabricated Metal Products	187.5	122.4	153.4
Transport Equipment and Other Machinery	217.1	165.2	131.4
Other Manufacturing	113.6	111.4	140.1
Total Manufacturing	**185.4**	**146.7**	**126.4**

Source: Appendix tables F:1 and F:2.

5.6.1 Absolute Labour Productivity Growth[13]

At a total manufacturing level, productivity levels in Taiwan and Australia grew by 85 per cent and 47 per cent respectively between 1986 and 1995, as shown by table 5.7. This represented a catch-up rate of Taiwan's labour productivity levels of 26 per cent since 1986. At branch level, non-metallic mineral products and basic and fabricated metals revealed the highest catch-up rates at 97 and 53 per cent respectively. Hence, despite some of this result being attributable to growth from a very low base level in Taiwan, most of the rapid reduction in productivity differentials from 1974 to 1995 can be attributed to rapid productivity growth in Taiwan relative to Australia.

The reason for the relatively higher labour productivity levels in Taiwan are likely to have been due to a decrease in employment levels and hours worked, an increase in output levels or both (OECD 1994:119). This in turn may have been due to the introduction of new technologies and production techniques in these branches relative to other branches.[14] Given that Taiwan has a comparative advantage in these

[13] See appendix tables F:1 and F:2 respectively for Australian and Taiwanese labour productivity indices at a manufacturing branch level using 1986 as a base year.

[14] The increased use of technology was required to offset increased labour costs in Taiwan, as noted in

industries, they are more likely to attract investment for new technology and production techniques. On the other hand, industries where Taiwan has a comparative disadvantage, namely food, beverages and tobacco and wood, wood products, paper and paper products, there is unlikely to be a relatively high level of investment to upgrade their technological and production capacities (Clark, Geer and Underhill 1996:23).

5.6.2 Structural Effects

It is possible that part of the labour productivity differential between Taiwan and Australia was attributed to differences in employment structures. For example, a low labour productivity level for one country relative to another may be due to a large share of the labour force that is employed in low productivity manufacturing branches (Van Ark 1993:134). This structural effect can be removed by obtaining the geometric average of branch level gross value added per person employed for Taiwan and Australia weighted by their respective shares of manufacturing employment.[15] This ensures that the share of labour input accounted by each manufacturing branch is consistent between Australia and Taiwan.

Table 5.8: Adjusted and Unadjusted Gross Value Added Per Person Employed for Structural Effects, 1986

Taiwan/Australia	(a) Unadjusted for Structural Effects	(b) Adjusted for Structural Effects
Total manufacturing	76.1	78.8

Note: Adjusted figure is the geometric average of value added per person employed weighted by Australian and Taiwanese employment weights.
Source: Column (a) from table 5.3; Column (b) calculated using employment data from appendix tables C:1 and C:2.

chapter three.

[15] The methodology for adjusting labour productivity levels for structural differences was obtained from Pilat, Prasada Rao and Shepherd (1993:10).

The results in table 5.8 show that once differences in employment structures were accounted for, the discrepancy in labour productivity levels narrowed from 76 per cent to 79 per cent in 1986. This suggests that Taiwan's manufacturing workers were disproportionately employed in low labour productivity branches, such as textiles, clothing and footwear. However, as is the case for most other ICOP and COPPAA studies, the adjustment results in only a marginal difference in the original estimate, suggesting this was only a minor factor in explaining the labour productivity differential between Australia and Taiwan.

5.7 Conclusion

The main conclusion drawn from chapter five was that Taiwan achieved significant catch-up in labour productivity and reductions in price levels, thereby strengthening its comparative advantage in manufacturing relative to Australia since the early 1970s. Using gross value added per person employed as a definition of labour productivity, most of Taiwan's manufacturing branches surpassed Australian labour productivity levels by the early 1990s. This gain was delayed slightly when Taiwan's longer hours were accounted for. The reasons for the rapid gain on Australian labour productivity levels was primarily due to rapid absolute growth in Taiwan's labour productivity levels, in part due to a comparatively low base. A marginal share of the remaining differences between Australian and Taiwanese labour productivity levels was attributed to a concentration of Taiwanese workers in relatively low labour productivity sectors, although this employment composition is likely to have changed since 1986.[16] The only manufacturing branches to consistently display a labour productivity level below Australian levels was for food, beverages and tobacco and wood, wood products, paper and paper products. This would seek to further confirm Taiwan's strong comparative disadvantage in these branches relative to Australia.

[16] Refer to appendix table C:2 and C:4 which illustrates the shifting sectoral employment structure.

- CHAPTER SIX -

COMPARISON OF RESULTS AND CONCLUSION

6.1. Introduction

Comparative advantage between Australia and Taiwan has been examined using two main measures, RCA index values in chapter four, and relative labour productivity and price levels in chapter five. The former assessed comparative advantage in terms of relative market shares, while the latter was derived using the industry-of-origin approach. Each method was considered the second best alternative to measuring comparative advantage in the absence of pre-trade prices.

Given that RCA index values and relative labour productivity levels are assumed in the present study to measure the same phenomenon, we would expect consistent results.[1] This chapter will determine whether this is the case by comparing their results. This process will begin by listing the sources necessary to reconcile the results of both methodologies. A comparison between results will then be made to identify any similarities. If a lack of concordance is evident for some industries, the possible reasons will be canvassed. The final section will conclude and summarise the main findings of this chapter and the present study in general.

6.2. Data Sources for Relative Labour Productivity Levels and RCA Index Values

A comparison of RCA index values and relative labour productivity levels required a re-estimation of their results. Relative labour productivity levels, in terms of value added per hour worked, were re-defined in terms of industry classes, rather than the industry sub-divisions that were used in chapter five.[2] All sources are the same as

[1] In theory, one would also expect a relatively high level of labour productivity to be associated with a relatively high share of exports. Balassa (1963:14), who found a high positive correlation between export shares and labour productivity, confirmed this.

[2] Industry classes are slightly more detailed than industry subdivisions. For example, 'textiles' and

those used in chapter five, though with the following exceptions. Australian GDP time series were obtained from *Constant Price Estimates of Manufacturing Production, Australia* (ABS Cat. No. 8211.0) between 1975-76 and 1989-90, and *Manufacturing Industry - Australia* (ABS Cat. No. 8221.0) for 1990-91 and 1991-92. The *Australian National Accounts - Input-Output Tables* (ABS Cat. No. 5209.0) were used for 1992-93 industry class GDP figures. All figures were re-based to 1991-92 prices using manufacturing price indices from *Yearbook Australia* (ABS Cat. No. 1301.0) and *Price Indexes of Articles Produced by Manufacturing Industry - Australia* (ABS Cat. No. 6412.0) to ensure consistency with Taiwan GDP figures. The sources listed in chapter five were used to obtain hours worked in Australian manufacturing, as was all GDP and employment data for Taiwan.[3]

For RCA index values, the two-digit SITC was found to concord most closely to the industry class level of manufacturing production. RCA index values were therefore re-calculated for each year between 1975 and 1992 using export and import data at this level of data aggregation, as opposed to the three-digit SITC used in chapter four. The main problem encountered when re-defining RCA index values at a two-digit level is that they tended not to yield the same results that were gleaned at a three-digit level in chapter four. For example, it may be the case that Taiwan has a comparative disadvantage at a manufacturing sub-division level, such as in transport equipment, but a comparative advantage in a niche industry within this group, such as non-motor road vehicles.[4] Therefore, it should be stated that the purpose is not to determine whether there is consistency between RCA index values at a two-digit and three-digit level, but solely to see whether RCA index values are consistent with relative labour productivity levels, as yielded by the industry-of-origin methodology.

'clothing and footwear' in the industry class classification are aggregated to 'textiles, clothing and footwear' at an industry sub-division level. The ABS shifted from industry class to industry sub-division classifications after 1992-93.

[3] As noted in chapter five, extrapolations could not be made beyond 1992 due to the absence of hours worked at an industry level in ABS publications.

[4] See Ballance (1988:9-11) for further discussion on this issue.

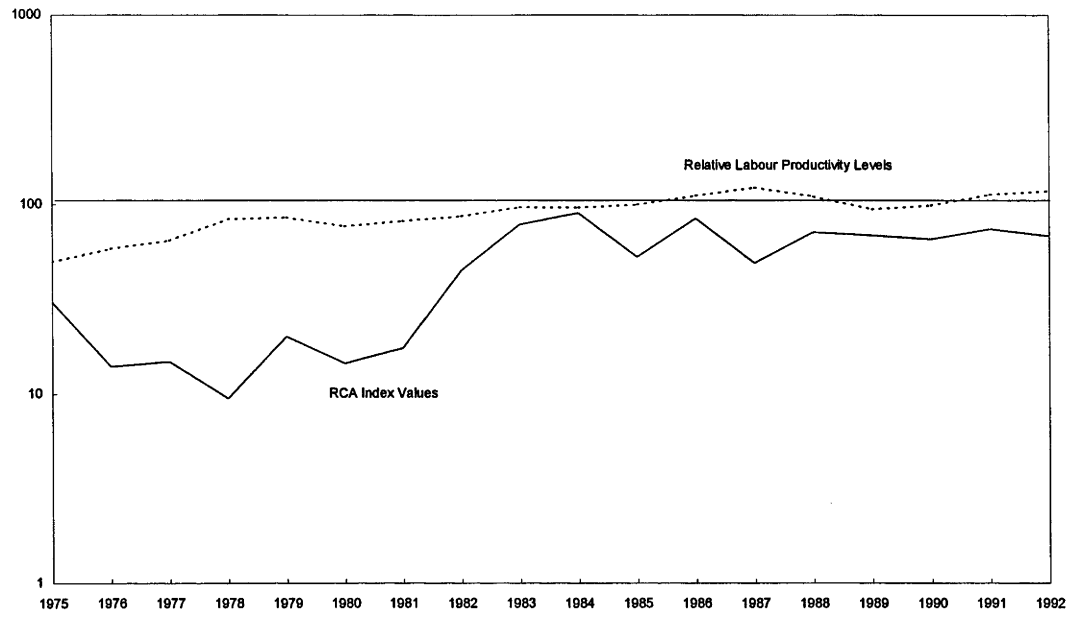
6.3. Analysis of Adjusted RCA Index Values and Relative Labour Productivity Levels

RCA index values and relative labour productivity levels were re-estimated for nine manufacturing industries - basic metals, transport equipment, other machinery equipment, other manufactures, textiles, clothing and footwear, wood and wood products, paper and paper products, and chemicals, coal and petroleum products. The categories differ from those estimated in chapter five in that 'textiles, clothing, leather and footwear' becomes 'textiles' and 'clothing and footwear', 'wood, wood products, paper, paper products' as 'wood and wood products' and 'paper and paper products', 'basic and fabricated metals' as 'basic metals', 'chemicals, chemical products, rubber and plastic products', as 'chemicals, coal and petroleum products' and 'transport equipment and other machinery' as 'transport' and 'other machinery and equipment'.[5] The category 'non-metallic mineral products' was unchanged from chapter five, as it was consistent at both an industry class and industry sub-division level.

Trends in relative labour productivity levels and RCA index values for each of the ten manufacturing industries is displayed in figures 6.1 to 6.10. Annual data were cited instead of the two- to three-year averages that were used in chapter four. This allowed for a greater focus on long term trends in RCA index values and relative labour productivity levels. As usual, RCA index values and relative labour productivity levels above/below 100 represented a comparative advantage/ disadvantage for Taiwan relative to Australia.

[5] A unit value ratio could not be computed for 'fabricated metals' since a product match could not be obtained between Australia and Taiwan for this industry. Other manufactures were adjusted to include rubber and plastic products, since they were omitted from the chemicals, coal and petroleum products category.

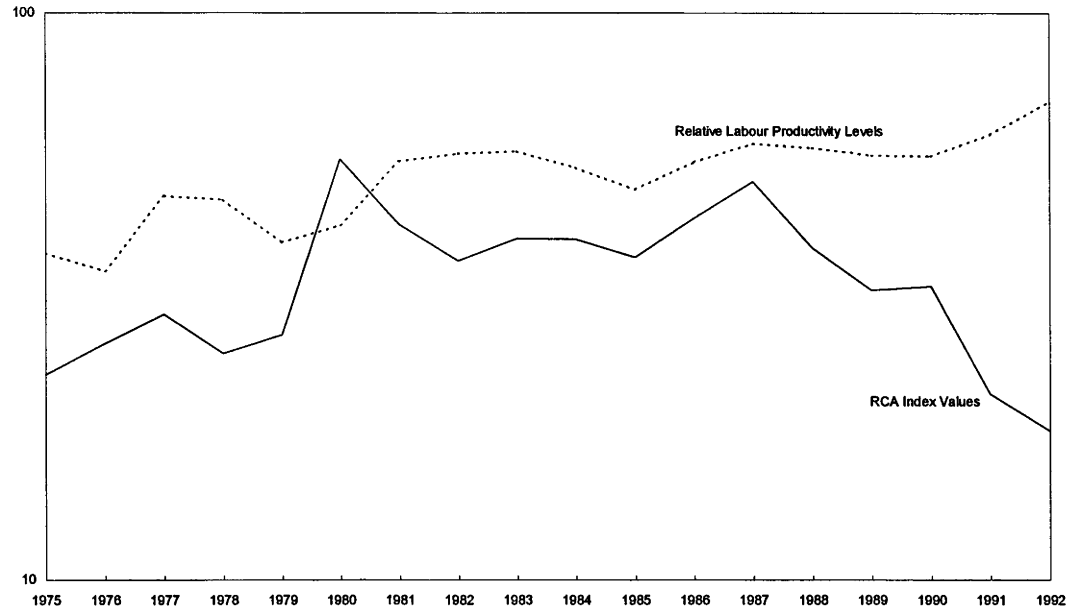
Figure 6.1: RCA Index Values and Relative Labour Productivity Levels for Basic Metals - Taiwan relative to Australia, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and appendix table E:1 respectively.

Figure 6.1 indicates that Taiwan, relative to Australia, had a comparative disadvantage in basic metals for most years between 1975 and 1992. Both relative labour productivity levels and RCA index values were below 100 except for 1986-88 and 1991-92. This suggests that a relatively low export share in the Australian market accompanied Taiwan's relatively low labour productivity levels. While relative labour productivity levels showed a comparative advantage in 1991 and 1992, more evidence would be required to determine that this represented a gain in comparative advantage.

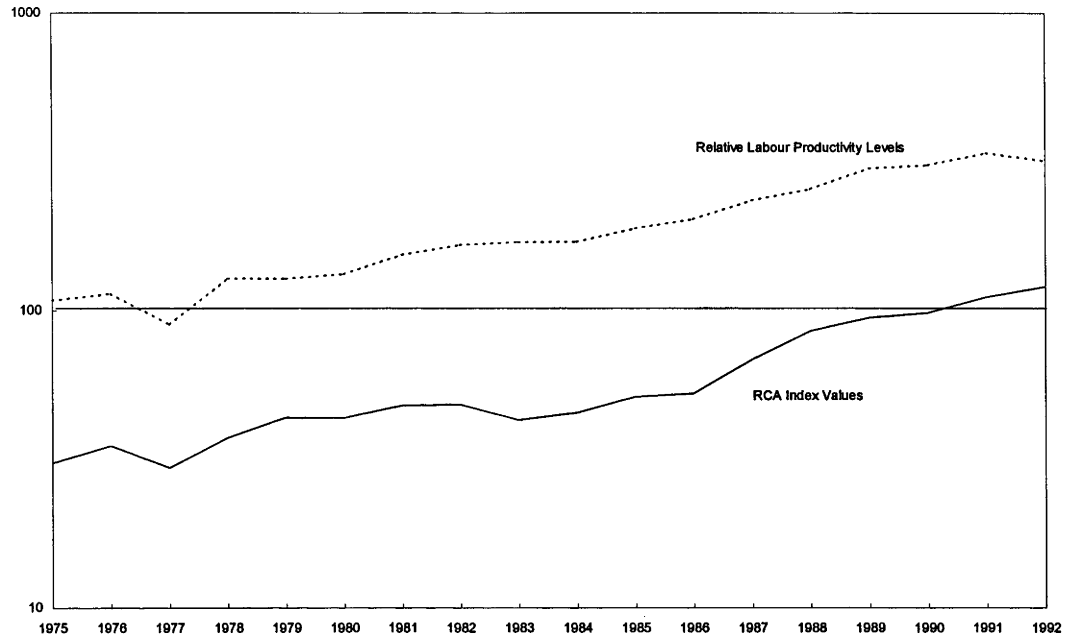
Figure 6.2: RCA Index Values and Relative Labour Productivity Levels for Transport Equipment - Taiwan Relative to Australia, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and appendix table E:1 respectively.

Taiwan was shown to have a comparative disadvantage in transport equipment relative to Australia by both measures. In figure 6.2, RCA index values and relative labour productivity levels consistently remained below 100 between 1975 and 1992, although trends were not always consistent. While similar trends seemed to be apparent during the 1980s, they were divergent for the remaining years. The comparative disadvantage shown by RCA index values had gradually strengthened by 1992, but had weakened by this year according to trends in relative labour productivity levels.

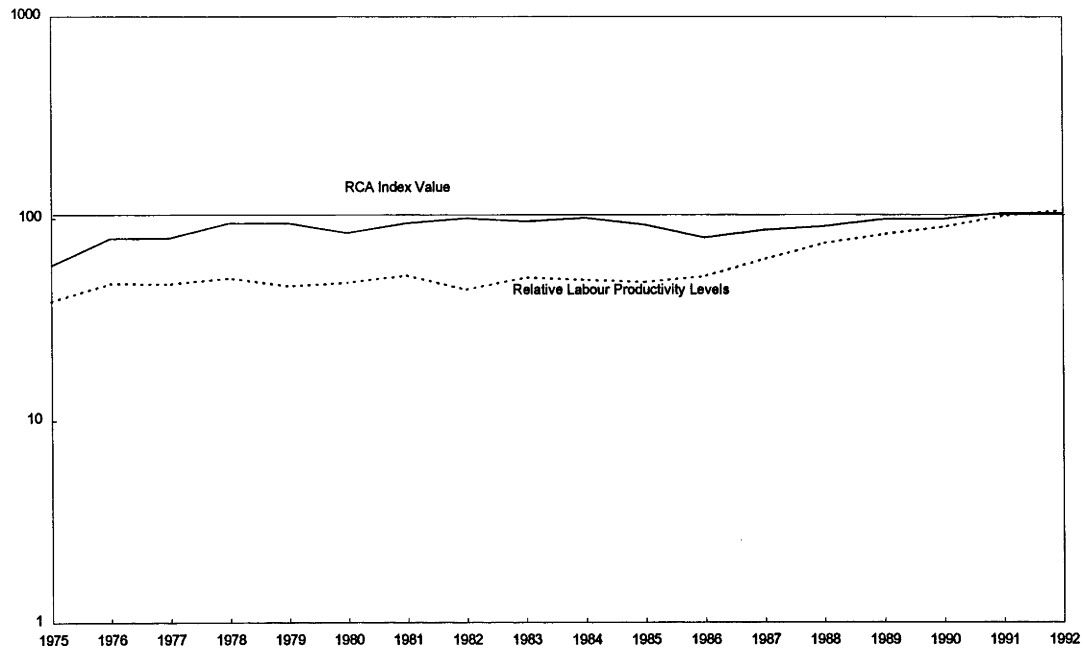
Figure 6.3: RCA Index Values and Relative Labour Productivity Levels for Other Machinery & Equipment - Taiwan relative to Australia, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and appendix table E:1 respectively.

Despite similar movements in RCA index values and relative labour productivity levels for other machinery and equipment, they were not consistent in predicting a comparative advantage, as shown by figure 6.3. Relative labour productivity levels displayed a comparative advantage for all years except 1977, whereas this was only evident for RCA index values in 1991 and 1992. This suggests that Taiwan's high level of labour productivity relative to Australia did not translate into a relatively high export share in the Australian market.

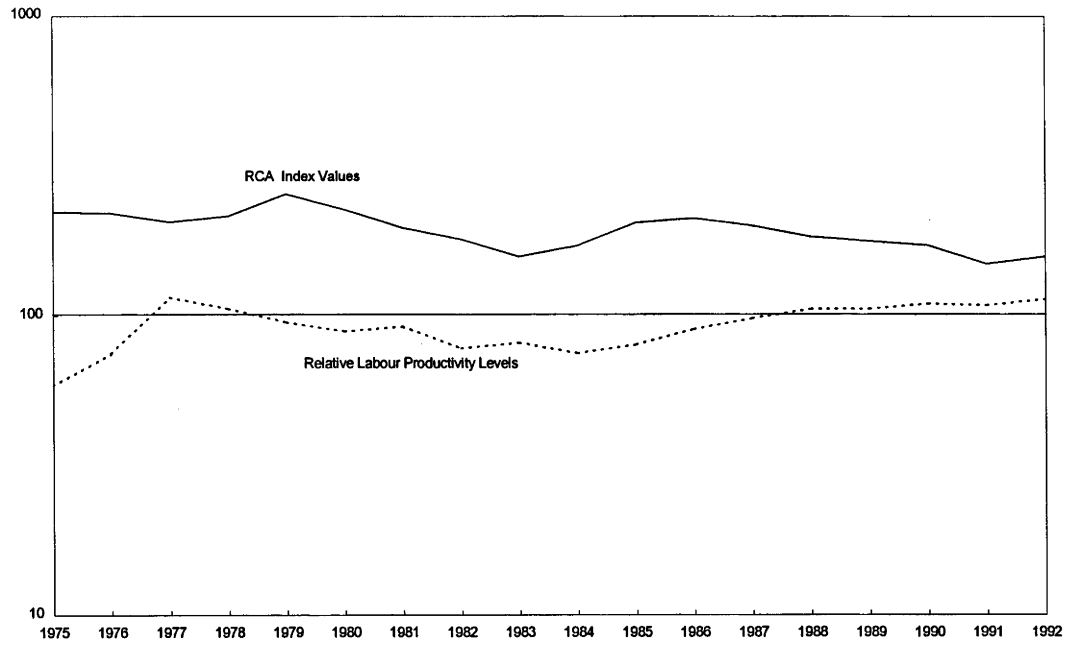
Figure 6.4: RCA Index Values and Relative Labour Productivity Levels for Non-Metallic Mineral Product, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and appendix table E:1 respectively.

According to figure 6.4, RCA index values and relative labour productivity levels yielded consistent results for non-metallic mineral products between 1975 and 1992. Both displayed comparative disadvantage between 1975 and 1990 and a gain in comparative advantage after 1991. Consistency was highest between 1991 and 1992, due to a rise in Taiwan's labour productivity level relative to Australia.

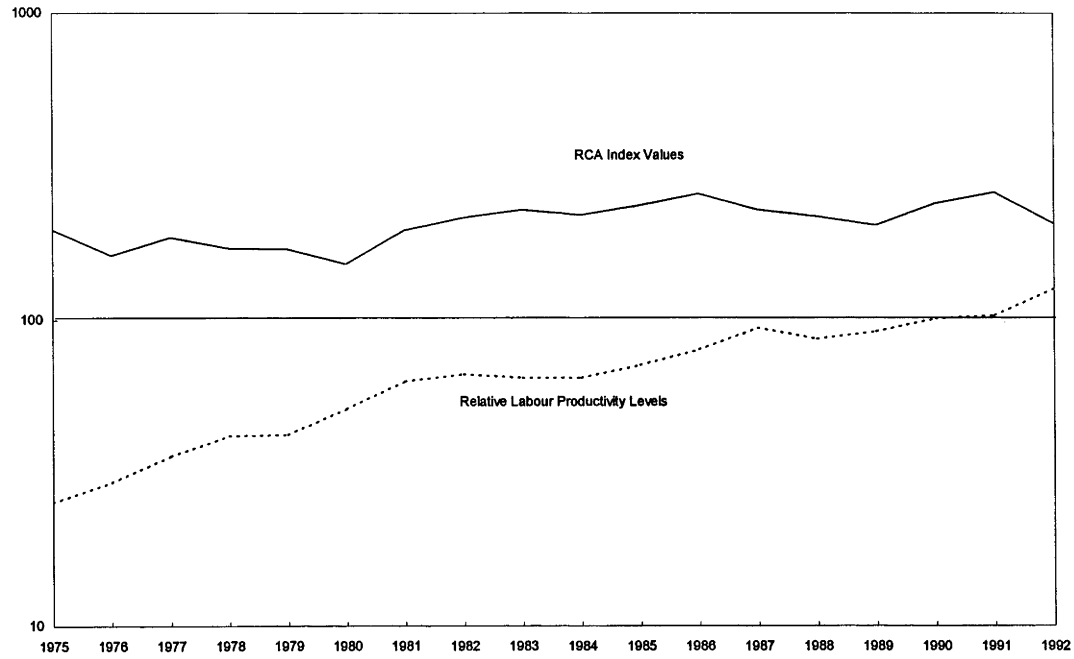
Figure 6.5: RCA Index Values and Relative Labour Productivity Levels for Other Manufactures - Taiwan relative to Australia, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and appendix table E:1 respectively.

Figure 6.5 shows that results for RCA index values and relative labour productivity levels for other manufactures were mixed between 1975 and 1992. While both sets of results exceeded 100 between 1978-80 and 1987-92, thereby suggesting a comparative advantage, relative labour productivity levels were below 100 for the remaining years, signifying a comparative disadvantage. RCA index values on the other hand displayed a comparative advantage for Taiwan relative to Australia at all times over the period considered.

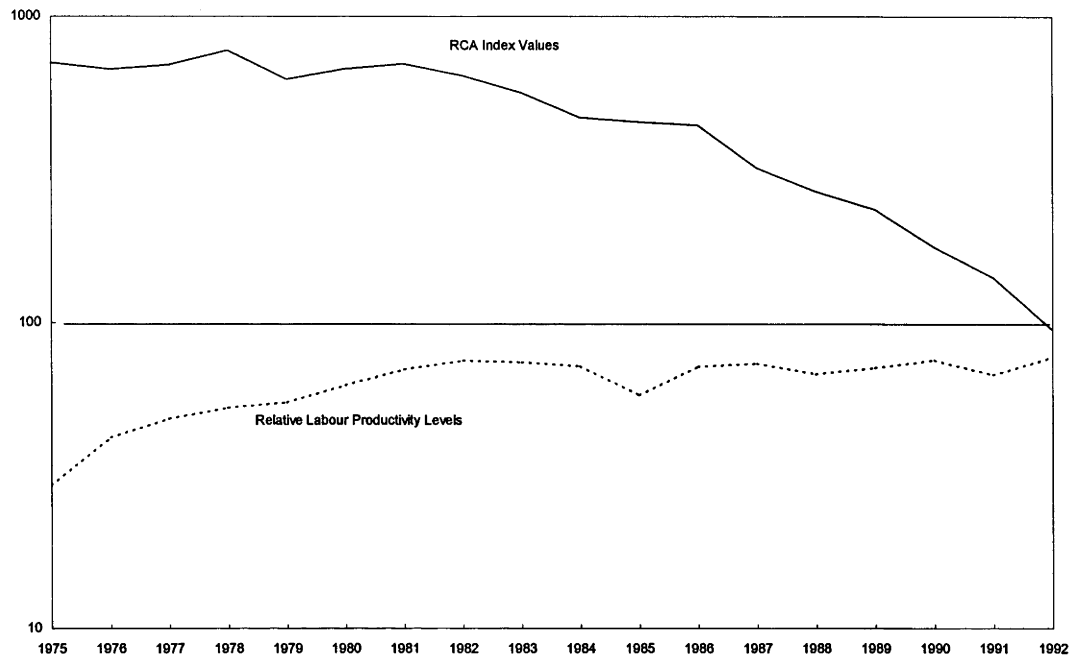
Figure 6.6: RCA Index Values and Relative Labour Productivity Levels for Textiles - Taiwan relative to Australia, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and appendix table E:1 respectively.

For textiles, a comparative advantage for Taiwan relative to Australia was not revealed by both measures until 1990 in figure 6.6. Only after 1990 did an increasing relative labour productivity level eventually exceed 100 to gain comparative advantage, while RCA index values consistently displayed a comparative advantage between 1975 and 1992. However, more evidence would be necessary to determine that both measures displayed a comparative advantage after 1990.

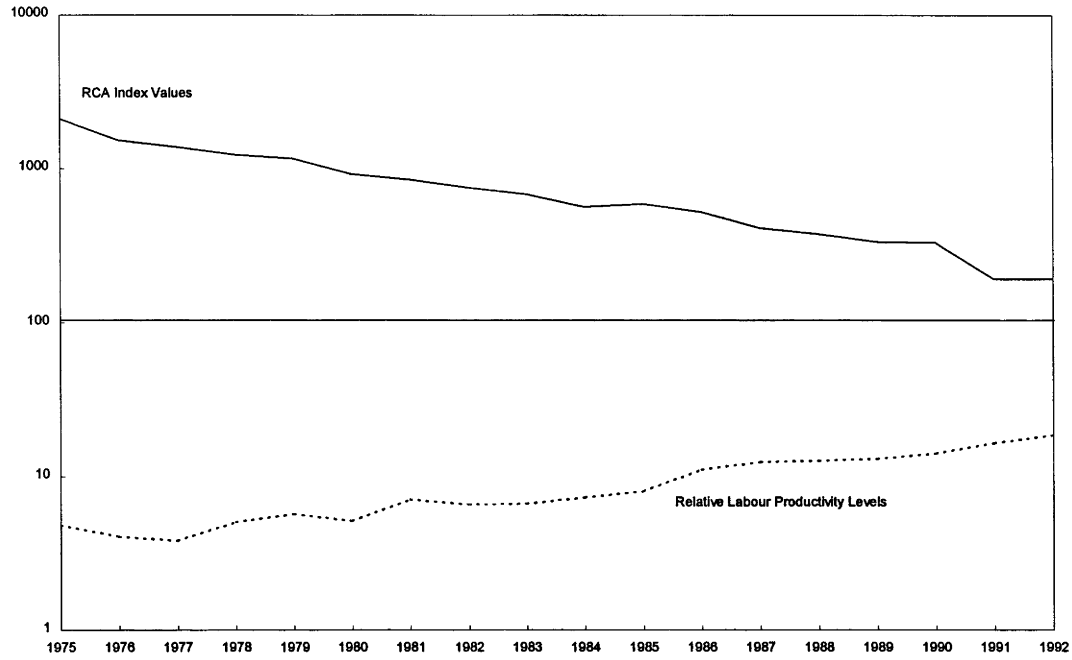
Figure 6.7: RCA Index Values and Relative Labour Productivity Levels for Clothing & Footwear, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and appendix table E:1 respectively.

Consistency in comparative advantage patterns also only became evident for clothing and footwear in the early 1990s, as figure 6.7 shows. RCA index values fell continuously between 1975 and 1992, indicating a gradual weakening in comparative advantage for Taiwan relative to Australia in 1992. Relative labour productivity levels, on the other hand, remained below 100 (comparative disadvantage) over the same period. The apparent conformity in results in 1992 would require further evidence to confirm that this indeed was the case.

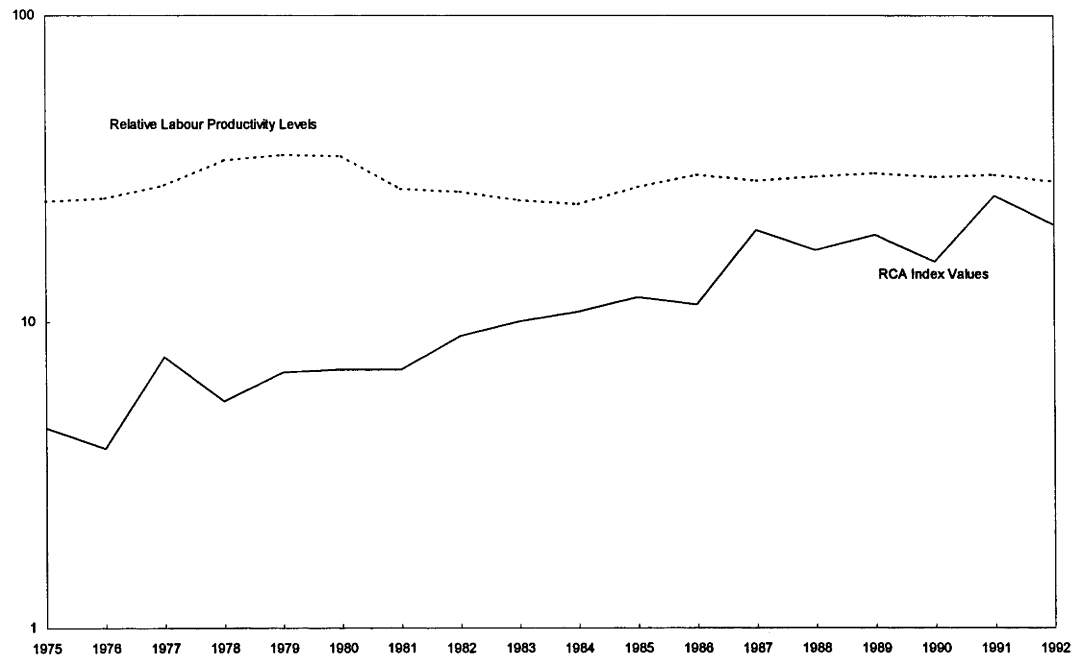
Figure 6.8: RCA Index Values and Relative Labour Productivity Levels for Wood & Wood Products - Taiwan Relative to Australia, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and appendix table E:1 respectively.

No relationship between RCA index values and relative labour productivity levels was evident for wood and wood products in figure 6.8. Between 1975 and 1992 RCA index values displayed an unusually strong comparative disadvantage during the mid-1970s, reflecting a higher than average market share in total Australian imports of wood and wood products. This share, however, fell gradually over the 17-year period to 1992. Labour productivity levels, on the other hand, consistently remained below 100, signifying that Taiwan had a comparative disadvantage in this industry relative to Australia over the same period.

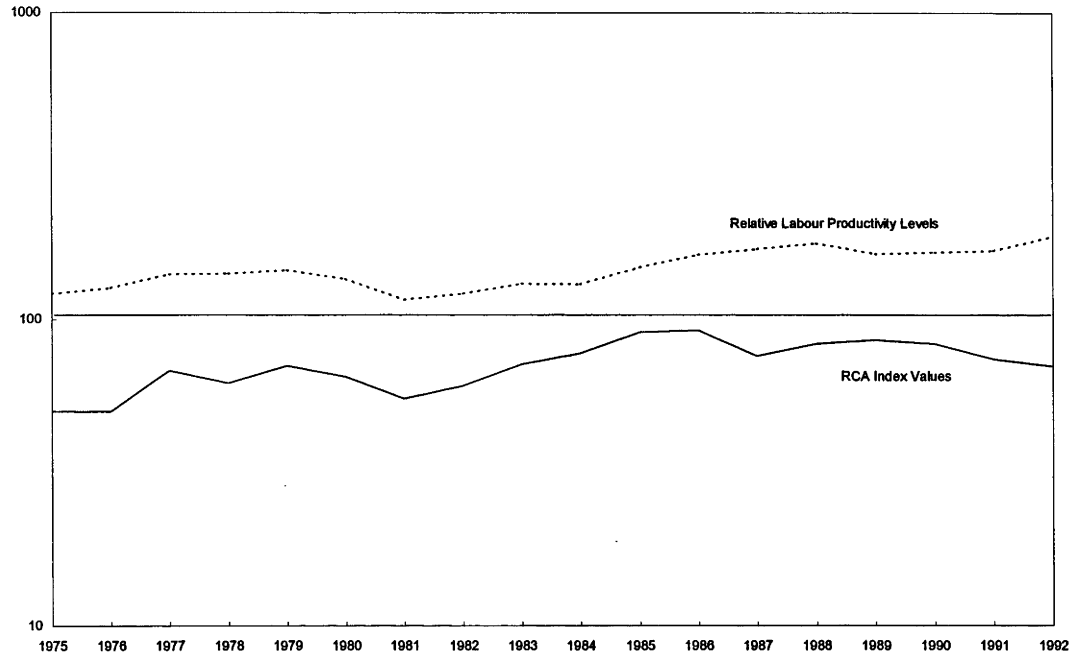
Figure 5.9: RCA Index Values and Relative Labour Productivity Levels for Paper & Paper Products - Taiwan Relative to Australia, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and appendix table E:1 respectively.

For paper and paper products, both relative labour productivity levels and RCA index values were below 100 in figure 6.9. Although broad trends in each measure were not consistent, they nonetheless show that Taiwan had a comparative disadvantage relative to Australia.

Figure 6.10: RCA Index Values and Relative Labour Productivity Levels for Chemicals, Coal & Petroleum Products - Taiwan Relative to Australia, 1975-92



Source: RCA index values and relative labour productivity levels from UN trade data, International Economic Databank, Australian National University and Appendix Table E:1 respectively.

RCA index values and relative labour productivity levels for the final industry, chemicals, coal and petroleum products did not display consistent results. Figure 6.10 shows that while relative labour productivity levels demonstrated a comparative advantage for Taiwan relative to Australia from 1975 to 1992, the below 100 RCA index values signified a comparative disadvantage over the same period. This was despite an apparent conformity in the general trend for both measures over most of this period.

In summary, figures 6.1 to 6.10 do not suggest that trends in relative labour productivity levels have a relationship with RCA index values. While four diagrams displayed consistent RCA index values and relative labour productivity levels for most of the period between 1975 and 1992, this was not evident for the remaining diagrams. Although four of the six remaining diagrams did in fact show consistent results after 1991, more evidence would be required to determine that this reflected a change in the long-term trend.

6.4 Summary and Conclusion

The law of comparative advantage states that countries will tend to export goods with relatively low autarkic prices, while importing goods with relatively high autarkic prices. Given that adherence to this rule allows for a maximisation of world efficiency, incomes and welfare, the concept has great relevance to both economists and governments. However, attempts to measure this concept in practice are seriously hampered by the inability to observe autarkic prices. Therefore, an empirical measurement of comparative advantage requires the use of a proxy. The closest approximation for autarkic prices is believed to be trade flows, since they reflect both costs and non-price factors (Balassa 1965). As well, relative labour productivity and price levels are both major factors in determining comparative advantage patterns (Van Ark and Pilat 1993:1).

The present study has undertaken a bilateral study of comparative advantage using market shares, relative labour productivity levels and relative prices. Market shares were represented by RCA index values while the industry-of-origin approach was used to express relative labour productivity levels in a single currency, as opposed to the use of market exchange rates. However, in the absence of autarkic prices, it cannot be certain which measure, if any, provides a more accurate reflection of comparative advantage. Hence, the results presented in this thesis should only be interpreted as a broad guide to comparative advantage patterns.

The thesis began with a review of the revealed comparative advantage and industry-of-origin literature in chapter two. The result of the review was that very few RCA and industry-of-origin studies have actually been conducted for Australia, with none having taken place for Taiwan. This therefore identified a void in the RCA and industry-of-origin literature that this thesis has sought to address.

The next chapter then discussed the role played by manufacturing and foreign trade as a prelude to the RCA and industry-of-origin analysis in chapters four and five respectively. As expected in an economy with a relatively low resource endowment,

respectively. As expected in an economy with a relatively low resource endowment, outward-oriented trade policies and small domestic market, manufacturing and foreign trade were of far greater importance to the Taiwan economy in terms of GDP, employment, exports and trade/GDP shares than to Australia. Only in terms of imports were manufactures found to be of greater relative importance to the Australian economy. The last section of chapter three discussed the role played by trade policies in Australia and Taiwan, given their possible influence on the RCA index values presented in chapter four. Taiwan scaled back it's import substitution policy after the late 1960s, while trade liberalisation was initiated after the early 1980s onwards in response to both internal and external pressures. For Australia, trade liberalisation was induced by pressures to raise export competitiveness, although special interest lobby groups have stalled this process somewhat.

In chapter four, the results of RCA index values for Australia and Taiwan were presented. Acknowledging the fact that comparative advantage is not static, RCA index values were averaged over three-year periods between 1965-67, 1972-74, 1982-84 and 1992-94. The results were displayed and discussed for 66 Australian industries and 57 Taiwanese industries that engaged in trade between both countries. However, given the possible distortions created by trade policies, greater emphasis was placed on the factor intensity of RCA index values. Using the Krause (1984) methodology, industries were classified as being intensive in unskilled labour, human capital, technology or natural resources.

The RCA index values showed Australia's comparative advantage in traded manufactures with Taiwan lay in human capital-intensive and natural resource-intensive industries. This result is consistent with Australia's highly skilled labour force and rich natural resource endowment. Australia was found to have a comparative disadvantage in technology-intensive and unskilled labour-intensive industries. Therefore, Australia should seek to shift resources towards human capital-intensive and natural resource-intensive manufactures if the gains from trade with Taiwan are to be maximised.

For Taiwan, the majority of industries with a comparative advantage were intensive in unskilled labour. This was despite evidence of falling RCA index values and increased levels of gross value added per worker by 1992-94. Subsequently, a growing number of human capital-intensive industries had gained a comparative advantage by 1992-94. A comparative disadvantage was apparent for both natural resource-intensive and technology-intensive manufactures. This was concluded from the low number of natural resource-intensive industries with an RCA index value above unity and a high number of industries with a consistent RCA index value below unity for technology-intensive industries.

The last section of chapter four examined whether comparative advantage had become more complementary or competitive between Australia and Taiwan from 1965-67 to 1992-94. The results confirmed Australia and Taiwan are natural trading partners. Only unskilled labour-intensive industries, such as textile products, showed that comparative advantage was competitive between Australia and Taiwan. However a more sophisticated research method such as rank correlation coefficients may be required for greater certainty on this result.

This thesis then undertook an analysis involving the development of purchasing power parities in chapter five. These purchasing power parities were assumed to represent the exchange rate that would have prevailed in the absence of speculative capital flows and impediments to factor and product flows between countries. The objective was to glean comparative advantage using the industry-of-origin methodology by converting Taiwanese relative labour productivity and price levels into Australian dollars. Labour productivity was defined in terms of both value added per person employed and value added per hour worked, although more weight was attached to the latter due to longer working hours in Taiwan relative to Australia.

For value added per person employed at a total manufacturing level, Taiwan's labour productivity level increased from less than half to almost equal the Australian level between 1974 and 1995 from 43 per cent to 98 per cent. Between 1975 and 1992, labour productivity increased from 38 per cent to 88 per cent when longer working

hours in Taiwan were accounted for. At a branch level, Taiwan's labour productivity was well above their Australian counterparts, particularly for textiles, clothing, leather and footwear, chemicals, chemical products, rubber and plastic products, transport equipment and other machinery, non-metallic mineral products and other manufacturing branches. The only exceptions were food, beverages and tobacco and wood, wood products, paper and paper products, remaining substantially below the Australian level. In summary therefore, Taiwan would appear to have had a comparative advantage in textiles, clothing and footwear, chemicals, transport and other machinery, non-metallic minerals and other manufacturing, with a comparative disadvantage in food, beverages and tobacco and wood, wood products, paper and paper products.

The labour productivity trends were mirrored by relative price trends, falling from 92 per cent to 46 per cent between 1974 and 1995 at a total manufacturing level. While price falls were recorded in all manufacturing branches, only food, beverages and tobacco and wood, wood products, paper and paper products showed prices exceeding Australian levels. The slight rise in prices observed after 1994 would require more evidence to suggest this reflected an end to the long-term reductions observed in previous years.

Several problems were identified with the use of the industry-of-origin approach to compare labour productivity levels for Taiwan relative to Australia. Nearly all of these problems were related to the product matching process, such as confidentiality rules, unique products and quality differences. This meant that only around 20 per cent of manufacturing output could be matched between Australia and Taiwan. This raises questions as to whether this is an adequate representation of total output. Therefore, until more effects are made to concord product classifications across countries and make product information more freely available in future production censuses, the industry-of-origin approach could continue to face substantial problems in comparing labour productivity levels across countries.

In chapter six, an attempt was made to reconcile RCA index values and relative labour productivity levels. One would expect consistent results as both are used to measure comparative advantage, as well as the fact that relatively high export volumes tend to be associated with relatively high labour productivity levels. However, a comparison of results showed a majority of industries did not display consistency in RCA index values and relative labour productivity levels. This outcome was attributable to a number of factors, including inconsistent data classifications, government policies and the inability to account for all influences on comparative advantage.

- CHAPTER SEVEN -

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Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7

Matching of Product Items, Australia-Taiwan, Dairy Products

Code	Australian Product Item	Unit	Quantity	$A Value ('000)	$A Unit Valu	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
051.00	Milk in powdered form-															
	Total		207718	356970	1.7	33126895	356970	92.80	Milk Powder	M.T.	9371	1494485	159.5	16104	1494485	92.80
051.88	Liquid whole milk	kL	307286	59906												
	Separated. standardised i.e. pasteurised. sterilised. homogenised. etc.-															
	Liquid whole milk-															
	Total		2557273	1042017	0.4	92265243	1042017	88.54	Fresh Milk	M.T.	64845	2339578	36.1	26423	2339578	88.54
051.92	Flavoured whole milk drinks		114119	90468	0.8	2105598	90468	23.27	Flavoured Milk	M.T.	126780	2339205	18.5	100505	2339205	23.27
	Ice cream															
	Total		205020	203330	1.0	12522151	203330	61.59	Ice Cream	M.T.	22393	1367713	61.1	22208	1367713	61.59
	Total Matched Items			**1692785**		**1.4E+08**	**1692785**	**82.72**	**Total Matched Items**			**6046496**		**149135.956**	**6046496**	**40.54**
	as a % of Total Gross Output			**60**					**as a % of Total Gross Output**			**57**				

Matching of Product Items, Australia-Taiwan, Fats and Oils

Code	Australian Product Item	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Valu	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Total refined single oils and fats	M.T.	28258	30948	1.1	998292	30948	32.26	Refined Soybean Oil	M.T.	171386	6054787	35.3	187704	6054787	32.26
	Total Matched Items			**30948**		**998292**	**30948**	**32.26**	**Total Matched Items**			**6054787**		**187704**	**6054787**	**32.26**
	as a % of Total Gross Output			**69**					**as a % of Total Gross Output**			**6**				

Matching of Product Items, Australia-Taiwan, Grain Mill Products

Code	Australian Product Item	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Valu	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
062.01	White Flour	M.T.	1145376	409403	0.4	11589666	409403	28.31	Flour	M.T.	757143	7661270	10.1	270633	7661270	28.31
	Total Matched Items			**409403**					**Total Matched Items**			**7661270**				
	as a % of Total Gross Output			**45**					**as a % of Total Gross Output**			**37**				

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Confectionery Products

Code	Australian Product Item	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Total chocolate confectionery	M.T.	80849	498847	6.17	11478585	498847	23.01	Chocolate	M.T.	2394	339888	141.97	14771	339888	23.01
	Total Matched Items			**498847**	**6.17**	**11478585**	**498847**	**23.01**	**Total Matched Items**			339888				
	as a % of Total Gross Output			**100**					**as a % of Total Gross Output**			**100**	**141.97**	**14771**	**339888**	**23.01**

Matching of Product Items, Australia-Taiwan, Prepared Animal Feeds

Taiwan Product Listing for fodder and feed

Code	Product Item	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Total animal foods	M.T.	2333191	1309962	0.5614	21582050.8	1309962	16.48	Mixed Feedstuff	M.T.	5357919	49560829	9.25	3008185	49560829	16.48
	Total Matched Items			**1309962**		**21582050.8**	**1309962**	**16.48**	**Total Matched Items**			**49560829**	**9.25**	**3008185**	**49560829**	**16.48**
	as a % of Total Gross Output			**100**					**as a % of Total Gross Output**			**100**				

Matching of Product Items, Australia-Taiwan, Carbonated Beverages

Code	Australian Product Item	Unit	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit (adjusted)	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
171.00	Aerated and carbonated waters - Total		1239563	900537	0.73	29655654	900537	32.93	Carbonated Beverages	1000 L	292239	6991608	23.92	212310	6991608	32.93
	Total Matched Items			**900537**		**29655654**	**900537**	**32.93**	**Total Matched Items**			**6991608**		**212310**	**6991608**	**32.93**
	as a % of Total Gross Output			**100**					**as a % of Total Gross Output**			**100**				

Matching of Product Items, Australia-Taiwan, Tobacco Products

Code	Australian Product Item	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit (adjusted)	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
182.03,	Cigars and cigarettes	No.	32492000000	586031	0.00	33337134	586031	56.89	Filter Tobacco	No.	31420560000	32237825	0.001	566706	32237825	56.89
	Total Matched Items			**586031**		**33337134**	**586031**	**56.89**	**Total Matched Items**			**32237825**		**566706**	**32237825**	**56.89**
	as a % of Total Gross Output			**100**					**as a % of Total Gross Output**							

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Knitting Mills

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Knitted or crocheted fabric-															
	Spencers, singlets and other vests -															
791.44	Women's		}													
791.45	Girls'		8666	19627												
	Women's briefs and panties, of, or predominantly of-															
791.53	Cotton		27750	42695					Other Knitted or Crocheted							
791.55	Other fibres		12215	26245					Women's Underwears	Doz.	33103548	805643				
791.58	Girls' briefs and panties		5534	8335					Knitted or Crocheted Women's Under Ga		6568488	1100064				
791.60	Slips and petticoats		2772	16160					Knitted or Crocheted Women's Under Tro	Doz.	31579884	1363879				
	Total		**56937000**	**113062**	**0.00**	**2612707**	**113062**	**23.11**	**Total**		**71251920**	**3269586**	**0.05**	**141488**	**3269586**	**23.11**
	Knitted or crocheted fabric-															
791.39	Singlets		4274	8688												
	Underpants (long and short) and briefs-								Other Knitted or Crocheted Men's Underwears							
	Total		**34092000**	**51442**	**0.00**	**2377626**	**51442**	**46.22**	**Total**		**24912516**	**1737435**	**0.07**	**37591**	**1737435**	**46.22**
789.00	Hosiery -															
	Total		345714000	198572	0.00	4907021	198572	24.71	Socks	number	224280000	3183402	0.01	128822	3183402	24.71
	Tracksuits, sweatsuits, jogging suits and jumpsuits-															
	Knitted or crocheted fabric-															
	Men's and women's -															
792.12	Complete suits		1449000	29362					Knitted or Crocheted							
792.13	Jackets only		487000	7965					Women's Sporting Wears	number	28132260	3725255				
792.14	Trousers only		666000	9556					Other Knitted or Crocheted Men's Garme	number	34470708	5401719				
	Total		**2602000**	**46883**	**0.02**	**379349**	**46883**	**8.09**	**Total**		**62602968**	**9126974**	**0.15**	**1127984**	**9126974**	**8.09**
	Women's knitted or crocheted T-shirts															
	Total	'000	4170000	38220	0.01	579387	38220	15.16	Knitted or Crocheted Women's T-Shirts	number	22563888	3135066	0.14	206809	3135066	15.16
	Women's Cardigans, jumpers, sweaters, pullovers and twin sets -															
	Total		5548000	97772	0.02	1506752	97772	15.41	Knitted or Crocheted Women's Sweater	number	86217456	23415346	0.27	1519404	23415346	15.41
	Women's dresses															
790.72	Knitted or crocheted fabric		1818000	56914	0.03	327711	56914	5.76	Knitted or Crocheted Women's Dresses		5947764	1072139	0.18	186200	1072139	5.76
	Men's Cardigans, jumpers, sweaters, pullovers and twin sets -															
	Knitted or crocheted-															
	Of, or predominantely of-															
	Wool or fine animal hair -															
	Total		3455000	83115	0.02	893538	83115	10.75	Knitted or Crocheted Men's Sweater		24714744	6391767	0.26	594549	6391767	10.75
	Total Matched Items			**685980**		**13584091**	**685980**	**19.80**	**Total Matched Items**			**51331715**		**3942846**	**51331715**	**13.02**
	as a % of Total Gross Output			**70**					**as a % of Total Gross Output**			**70**				

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Woven Fabric Apparel

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Skirts															
	Woven fabric-															
790.80	Women's		3313000	73523	0.02	763923	73523	10.39	Woven Fabric Women's Skirt	number	9519048	2194935	0.23	211249	2194935	10.39
									Woven Fabric Women's Jacket	number	5451972	1987580				
									Woven Fabric Women's Overcoat & Coat	number	5802492	2198155				
790.91	Woven coats, blazers and jackets		615000	33895	0.06	228729	33895	6.75	**Total**		**11254464**	**4185735**	**0.37**	**620277**	**4185735**	**6.75**
	Women's dresses															
790.75	Woven fabric		5947000	172850	0.03	2073374	172850	12.00	Woven Fabric Women's Dresses	number	11030904	3845837	0.35	320614	3845837	12.00
	Men's and boys' woven coats, blazers and jackets															
	Suit coats															
790.45	Men's		144000	19949												
790.49	Sports coats, blazers and jackets		312000	24939					Woven Fabric Men's Jacket	number	20999700	6862770				
790.53	Other woven coats and jackets		360000	13143					Woven Fabric Men's Overcoat & Coat	number	2808036	1636484				
	Total		**816000**	**58031**	**0.07**	**291308**	**58031**	**5.02**	**Total**		**23807736**	**8499254**	**0.36**	**1693121**	**8499254**	**5.02**
	Total Matched Items			**338299**		**3357335**	**338299**	**9.92**	**Total Matched Items**			**18725761**		**2845261**	**18725761**	**6.58**
	as a % of Total Gross Output			**44**					**as a % of Total Gross Output**			**22**				

Matching of Product Items, Australia-Taiwan, Shoes

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
793.00	Total Leather Shoes		19818000	480722	0.02	5911843	480722	12.30	Leather Shoes	prs.	109398107	32634195	0.30	2653652	32634195	12.30
	Total Rubber Shoes		6539	70265	10.75	754628	70265	10.74	Rubber Shoes	1000 prs.	28990	3345569	115.40	311513	3345569	10.74
	Total Matched Items			**550987**		**6666472**	**550987**	**12.10**	**Total Matched Items**			**35979764**		**2965165**	**35979764**	**12.13**
	as a % of Total Gross Output			**100**					**as a % of Total Gross Output**			**40**				

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Leather Tanning and Finishing

Code	ralian Product	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Produc	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
301.48	Other Suede-	m^2	314000	7279												
301.57	Grain	m^2	120000	1215					Upper Skin Le	m^2	40053609	16018513				
301.63, 65	Upholstery an	m^2	1660000	47406					Cattle or Cowh	m^2	14577512	2668865				
	Total		**2094000**	**55900**	**0.03**	**716283.4812**	**55900**	**12.81**	**Total**		**54631121**	**18687378**	**0.34**	**1458395**	**18687378**	**12.81**
301.32	Other	tonne	107	734	6.86	16633.20279	734	22.66	Sole Skin Leat	k.g.	2240	348266	155.45	15368	348266	22.66
	Total Matched Items as a % of Total Gross Output			**56634** **17**		**732916.684**	**56634**	**12.94**	**Total Matched Items as a % of Total Gross Output**			**19035644** **100**		**1473764**	**19035644**	**12.92**

Matching of Product Items, Australia-Taiwan, Wood and Wood Products

Code	ralian Product	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	iwan Product It	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
334.00	Plywood- Total	m^2	83988000	79489	0.001	5419830	79489	68.18	Processed Ply	m^2	189283096	12214629	0.06	179144	12214629	68.18
	Veneers, plywood and corestock- Total	m^2	28876	31371	1.09	1369602	31371	43.66	Total	m^2	174066	8256029	47.43	189106	8256029	43.66
	Total Matched Items as a % of Total Gross Output			**110860** **6**		**6789432.14**	**110860**	**61.24**	**Total Matched Items as a % of Total Gross Output**			**20470658** **62**		**368250**	**20470658**	**55.59**

Matching of Product Items, Australia-Taiwan, Pulp and Paper Products

Code	ralian Product	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	iwan Product It	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
352.01	Paper board (i	M.T.	542179.08	455862	0.84	7457707	455862	16.36	Total Paperboa	M.T.	2004157	27567303	13.76	1685087	27567303	16.36
	Total paper	M.T.	1102896	1044546	0.95	28897039.03	1044546	27.66	Total Paper	M.T.	781522	20476706	26.20	740175	20476706	27.66
357.00	Corrugated Pa	$000m^2$	32813	29012	0.88	555681	29012	19.15	Corrugated Pa	$000m^2$	681213	11536187	16.93	602302	11536187	19.15
	Total Matched Items as a % of Total Gross Output			**1529420** **100**		**36910426**	**1529420**	**24.13**	**Total Matched Items as a % of Total Gross Output**			**59580196** **60**		**3027565**	**59580196**	**19.68**

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Chemical Products

Code	Australian Product Item	Unit	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Paints and allied products-	K.L.														
	Total		188645	722985	3.83	10645838	722985	14.72	Paints /	M.T.	129770	7323334	56.43	497346	7323334	14.72
	Printing Inks															
419.00	Total		14733.4	98147	6.66	1549628	98147	15.79	Printing Ink	M.T.	16533	1738902	105.18	110135	1738902	15.79
	Shampoo															
805.08	Liquid, paste and cream		1883.38	6279	3.33	38885	6279	6.19	Hair Cleaning	M.T.	105494	2178054	20.65	351707	2178054	6.19
	Liquid (disinfectant type)															
805.30	Small packs	}														
805.52	Large packs	}	7992	7864		8691										
	Liquid (non-disinfectant type)															
805.32	Small packs		696	684.864		981										
805.54	Large packs		376	369.984		580										
805.03	Powdered (other than shampoo)	}														
805.05	Liquid, paste and cream (other than shampoo)	}	414	407.376		2655										
	Flakes and chips-	}														
805.24	Small packs	}														
805.48	Large packs	}														
	Powder and granule-	}														
805.26	Small packs	}														
805.50	Large packs	}	17954	17666.7		17905			Liquid Cleaning	M.T.	1638766	1629957				
									Powder Soap	M.T.	137162	4732334				
	Total		26993.1	30812	1.14	96703	30812	3.14	Total		1775928	6362291	3.58	2027182	6362291	3.14
	Total Matched Items			**858223**		**12331053**	**858223**	**14.37**	**Total Matched Items**		**13016218**	**6362473**		**959191**	**13267472**	**13.83**
	as a % of Total Gross Output			**41**					**as a % of Total Gross Output**			**88**				

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Basic Chemicals

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
404.88	Polyvinyl Acetate	M.T.	10045	63493	6.32	1355610	63493	21.35	Vinyl Acetate (VAM)	M.T.	75804	1618457	21.35	479162	1618457	3.38
403.73	Polystyrene	M.T.	59040	102570	1.74	2017690	102570	19.67	Polystyrene (PS)	M.T.	219772	7510702	34.17	381809	7510702	19.67
403.74	Polypropylene	M.T.	150552	159515	1.06	4138024	159515	25.94	Polypropylene (PP)	M.T.	221995	6101683	27.49	235211	6101683	25.94
403.65	Polyethlylene	M.T.	230256	292788	1.27	6154414	292788	21.02	Total Polyethlylene		410153	10962804	26.73	521541	10962804	21.02
403.62	Polyesters	M.T.	24600	57002	2.32	1047922	57002	18.38	Polyester Filament Total	M.T.	669263	28509566	42.60	1550786	28509566	18.38
413.00	Synthetic-Total		15760	33042	2.10	529512	33042	16.03	Synthetic Rubber		147242	4947188	33.60	308709	4947188	16.03
	Total Matched Items			**708410**		**15243172**	**708410**	**21.52**	**Total Matched Items**			**59650400**		**3477217**	**59650400**	**17.15**
	as a % of Total Gross Output			**59**					**as a % of Total Gross Output**			**32**				

Matching of Product Items, Australia-Taiwan, Rubber Tyres and Tubes

Code	Australian Product Item	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity value Taiwan Unit Values	Australian Quantity value Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity value Australian Unit Values	Taiwan Quantity value Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Rubber tyres and tubes-															
	Tyres-															
	Pheumatic-															
	Passenger car. utility and motor cycle-	'000														
621.31	Radial ply		5576	222504					Automobile Tyre	1000 pcs	5486	5946053				
621.32	Other		557	100871					Motorcycle Tyre	1000 pcs	9506	1604428				
	Total		6133	323375	52.73	3088787	323375	9.55	Total		14992	7550481	503.63	790483.9	7550481	9.55
	Total Matched Items			**323375**		**3088787**	**323375**	**9.55**	**Total Matched Items**			**7550481**		**790484**	**7550481**	**9.55**
	as a % of Total Gross Output			**71**					**as a % of Total Gross Output**			**39**				

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Iron and Steel Products

Code	Australian Product Item	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	From blast furnaces-	'000 M.T.														
442	Basic iron (incl. flat iron, basic pig iron)															
	Iron casting-															
442	Foundry pig iron															
442	Other															
	Total		171216	36957	0.22	2012306	36957	54.45	Pig Iron	M.T.	145996	1715895	11.75	31513	1715895	54.45
	Cast iron -															
448	Moulded (incl. pipe specials and fittings) or spun	M.T.	81878	114896	1.40	1854845	114896	16.14	Cast Irons	M.T.	195459	4427901	22.65	274281	4427901	16.14
	Welded steel (incl. welded conduit but excl. sheet metal)-															
	Outside diameter 80 mm and under or outside perimeter 250 mm and under-															
447	Stainless steel		}													
	Other steel-		}													
447	Galvanised		}													
447	Ungalvanised-		}													
	Outside diameter 80 mm and under or outside perimeter over 250 mm -		}													
447	Stainless steel		}													
	Other steel-		}													
447	Galvanised		}													
	Ungalvanised-		}													
448	Uncoated and/or unlined		}						Seam Steel Tube	M.T.	393115	6727551				
448	Coated and/or lined (steel content)		}						Zinc Plating of Steel Tube	M.T.	93136	1941942				
	Total		469133.8	438077	0.93	8364306	438077	19.09	**Total**		**486251**	**8669493**	**17.83**	**454061**	**8669493**	**19.09**
	Total Matched Items			**589930**		**12231457.6**	**589930**	**20.73**	**Total Matched Items**			**14813289**		**759855**	**14813289**	**19.49**
	as a % of Total Gross Output			**61**					**as a % of Total Gross Output**			**15**				

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Non-Ferrous Metal Products

Code	ralian Product	Unit	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	wan Product I	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Copper and alloy (except brass)-															
452.16	Rods, bars an	M.T.	4570.68	19661	4.30	301213	19661	15.32	Copper Rod	M.T.	34443	2269832	65.90	148158	2269832	15.32
451.50	Sheets, plate,	M.T.	164934.144	523416												
451.70	Foil	M.T.	19099.44	85464												
	Total		184033.584	608880	3.31	16349601	608880	26.85	Aluminium S	M.T.	22481	1997219	88.84	74379	1997219	26.85
	Total Matched Items			**628541**		**16650813.47**	**628541**	**26.49**	**Total Matched Items**			**4267051**		**222537**	**4267051**	**19.17**
	as a % of Total Gross Output			**59**					**as a % of Total Gross Output**			**22**				

Matching of Product Items, Australia-Taiwan, Cement and Cement Products

Code	Australian Pro	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Produ	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan uantity valued Australian Unit Values	Taiwan uantity valued Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
474.02	Cement (portl	'000 tonnes	5589120	628056	0.11	11072453	628056	17.63	Cement	M.T.	15324924	30359789	1.98	1722079.8	30359789	17.63
475.90	Ready-mixed	m^3	14079000	1189790	0.08	15531551	1189790	13.05	Ready Mixed	m^3	9075544	10011881	1.10	766957.3	10011881	13.05
	Total Matched Items			**1817846**		**26604004**	**1817846**	**14.63**	**Total Matched Items**			**40371670**		**2489037.044**	**40371670**	**16.22**
	as a % of Total Gross Output			**80**					**as a % of Total Gross Output**			**100**				

Matching of Product Items, Australia-Taiwan, Bricks

Code	ralian Product	Unit (adjusted)	Australian Quantity (Sales)	$A Value ('000)	$A Unit Value	Australian uantity valued Taiwan Unit Values	Australian uantity valued Australian Unit Values	PPP NT/$A Australian Quantity Weights	wan Product I	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Refractories-															
472.43	Bricks, blocks	tonne	49722.504	26741	0.54	536163	26741	20.05	Refractory Bri	M.T.	57219	616998	10.78	30773	616998	20.05
	(inc. insulating bricks and blocks)															
	Clay bricks (saleable bricks removed from kiln, exc. firebricks)-															
	For structural purposes-															
	For structural purposes-															
471.91	Standard size	million	1676	436415												
471.93	Other than standard size		99	29889												
471.98	For other purposes		155	49957												
			1930	516261	267.5	3250207	516261	6.30	Red Brick	(adjusted) million	1820.695	3066132	1684	487023	3066132	6.30
	Total Matched Items			**543002**		**3786369.08**	**543002**	**6.97**	**Total Matched Items**			**3683130**	**1695**	**517795**	**3683130**	**7.11**
	as a % of Total Gross Output			**97**					**as a % of Total Gross Output**			**34**				

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Motor Vehicles & Equipment

Code	Australian Product Item	Unit (adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Passenger motor vehicles for less than 10 persons, complete, assembled (incl. assembled from kits)-															
	Cars-															
551.00	Engine capacity not exceeding 1.5 litres		17567	156906												
551	Engine capacity exceeding 1.5 litres bot not exceeding 2 litres		88612	843446												
551	Engine capacity exceeding 2 litres but not exceeding 3 litres	}														
551	Engine capacity exceeding 3 litres	}	144784	1761429												
	Station Wagons-															
551.1	Engine capacity not exceeding 2 litres		15587	174306												
551.1	Engine capacity exceeding 2 litres but not exceeding 3 litres	}														
551.1	Engine capacity exceeding 3 litres	}	36803	440290												
551.1	Passenger motor vehicles for 10 persons or more,		806	111953												
551.2	Non-passenger motor vehicles		6009	406474												
551.3	Motor vehicles for goods and materials		14767	275977												
551.2	Other motor vehicles		208	12836												
	Total		**325143**	**4183617**	**12.87**	**72052798.03**	**4183617**	**17.22**	Passenger and Freight Car	set	21574	4780872	221.60	277592.8	4780872	17.22
	Total Matched Items			**4183617**		**72052798.03**	**4183617**	**17.22**	**Total Matched Items**			**4780872**		**277592.8**	**4780872**	**17.22**
	as a % of Total Gross Output			**80**					**as a % of Total Gross Output**			**7**				

Matching of Product Items, Australia-Taiwan, Industrial Machinery

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Air compressors (capacity at pressure 700 kPa)															
	Complete with electric motor-															
507	Under 15 litres/sec. F.A.D.	number	5786	3473												
507	15 to 30 litres.sec. F.A.D.		767	2564												
507	31 to 60 litres.sec. F.A.D.		221	2122												
507	61 to 100 litres.sec. F.A.D.		135	1803												
507.1	over 100 litres.sec F.A.D.		234	7374												
	Complete with engine-															
507.1	Under 15 litres/sec. F.A.D.	}														
507.1	15 to 30 litres.sec. F.A.D.	}														
507.1	31 to 60 litres.sec. F.A.D.	}														
507.1	61 to 100 litres.sec. F.A.D.	}														
507.2	over 100 litres.sec F.A.D.	}														
507.3	Incomplete (without motor or engine)	}														
507.3	Air compressors not rateable at pressure 700 kPa	}	13839	15983												
	Total		20982	33319	1.59	162964	33319	4.89	Air Compressor	set	168866	1311556	7.77	268156	1311556	4.89
513	Fork lift		2066	33385	16.16	849998	33385	25.46	Fork Lift	set	1400	575991	411.42	22623	575991	25.46
	Total Matched Items			**66704**		**1012962.083**	**66704**	**15.19**	**Total Matched Items**			**1887547**		**290778.8029**	**1887547**	**15.19**
	as a % of Total Gross Output			**51**					**as a % of Total Gross Output**			**22**				

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Australia-Taiwan, Cotton Textiles

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
383.00	Of, or predominantly of, cotton	M.T.														
	Total cotton yarn		13969	58428	4.18	1274872	58428	21.82	Cotton Yarn (Cotton 100%)	M.T.	169410	15461251	91.27	708596	15461251	21.82
	Total Matched Items			**58428**		**1274872**	**58428**	**21.82**	**Total Matched Items**			**15461251**		**708596**	**15461251**	**21.82**
	as a % of Total Gross Output			**20**					**as a % of Total Gross Output**			**21**				

Matching of Product Items, Australia-Taiwan, Wool Textiles

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Total wool yarn	M.T.	18616	201915	10.8	2689091	201915	13.32	Combed Wool Man-Made Fiber Yarn	M.T.	14542	2100566	144.4	157725	2100566	13.32
	Total Matched Items			**201915**					**Total Matched Items**			**2100566**				
	as a % of Total Gross Output			**50**					**as a % of Total Gross Output**			**95**				

Matching of Product Items, Australia-Taiwan, Synthetic Fibre Textiles

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Of, or predominantly of, discontinuous synthetic fibres-															
	Polyester mixed with-	M.T.														
	Other than cotton-															
383.51	Containing 85% or more by weight of polyester fibres															
383.65	Containing less than 85% by weight of polyester fibres		1325.448	8578	6.47	116293	8578	13.56	Polyester Mixed Yarn	M.T.	168033	14743031	87.74	1087472	14743031	13.56
	Warp knit (excl. pile) fabrics, of, or predominantely of-	M.T.														
789.97	Man-made fibres		6517	65904												
789.93	Other fibres		142	1682												
	Total		**6552**	**67586**	**10.31**	**1041437**	**67586**	**15.41**	Warp-Knitted Fabrics	M.T.	41192	6546993	158.94	424879	6546993	15.41
	Total Matched Items			**295765**		**4127209**	**295765**	**13.95**	**Total matched products**			**37432508**		**2555797**	**37432508**	**14.65**
	as a % of Total Gross Output			**66**					**as a % of total output**			**30**				

Appendix Table A:1: Product Matching Between Australia and Taiwan, 1986-7 (Cont.)

Matching of Product Items, Power Wires & Cables

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Power transmission and distribution (incl. household and building wires, cords, etc.)-															
	Copper (copper content)-	tonne							Power Wire	M.T.	143090	11566328				
									Power Cable	M.T.	32485	2824997				
464.28	Paper insulated		3436	22316												
464.29	Otherwise insulated		38483	307446												
464.39	Aluminium (aluminium content)		3944	26480												
	Total		45863	356242	7.77	3759265	356242	10.55	Total		175575	14391325	81.97	1363776	14391325	10.55
	Electric and telephone cable, wire and strip -															
	Insulated -															
	Power transmission and distribution (incl. household and building wires, cords, etc.)-															
	Copper (copper content)-	tonne														
	Communications, electronics and appliances -															
464.44	Copper (copper content)		12914	173964												
464.51	Automotive low voltage cables, wires, etc.		159202	21068					Telecommunicaton Wire	M.T.	36248	3003352				
	Straightened cut lengths of steel wire, n.e.i. (round, strip and section) -								Telecommunication Cable	I	35717	3183617				
469.02	Steel	tonne	4063	4630					Electronic Wire	M.T.	62111	5851506				
	Total		**176179**	**199662**	**1.13**	**15818864**	**199662**	**79.23**	**Total**		**134076**	**12038475**	**89.79**	**151947**	**12038475**	**79.23**
	Total Matched Items			**555904**		**19578130**	**555904**	**35.2**	**Total Matched Items**			**26429800**		**1515722**	**26429800**	**17.44**
	as a % of Total Gross Output			**100**					**as a % of Total Gross Output**			**100**				

Matching of Product Items, Australia-Taiwan, Electrical Appliances

Code	Australian Product Item	Unit (Adjusted)	Quantity	$A Value ('000)	$A Unit Value	Australian Quantity valued at Taiwan Unit Values	Australian Quantity valued at Australian Unit Values	PPP NT/$A Australian Quantity Weights	Taiwan Product Item	Unit	Quantity	$NT Value ('000)	$NT Unit Value	Taiwan Quantity valued at Australian Unit Values	Taiwan Quantity valued at Taiwan Unit Values	PPP NT/$A Taiwanese Quantity Weights
	Cooking stoves, ovens and ranges -															
	Electric-															
	Total		251567	105629	0.42	208789	105629	1.98	Electric Cooker	Set	627618	520894	0.83	270175	520894	1.98
	Electric fans-															
696.05	Over 40 cm diameter	}	602605	20675	0.03	357296	20675	17.28	Total Electric Fans		27746410	16451368	0.59	951962	16451368	17.28
647.00	Colour-	'000														
	Total		220000	116718	0.53	1655767	116718	14.19	Colour TV	Set	3601156	27103070	7.53	1910544	27103070	14.19
657.00	Refrigeration equipment-		46486	129556	2.79	696670	129556	5.38	Refrigerator (Set)		412065	6175482	14.99	1148421	6175482	5.38
657.00	Air conditioning (complete units)-	no.														
	Total		**121709**	**100936**	**0.83**	**3750805**	**100936**	**37.16**	Total air conditioners		259534	7998269	30.82	215237	7998269	37.16
	Total Matched Items			**478135**					**Total Matched Items**			**58249083**		**4496340**	**58249083**	**12.95**
	as a % of Total Gross Output			**89**		**6669327**	**473514**	**14.08**	**as a % of Total Gross Output**			**29**				

Sources: *1986-87 Manufacturing Industry: Details of Operations, Australia* (ABS Cat. No. 8203.0), Canberra: AGPS. for Australia; and Directorate-General of Budget, Accounting and Statistics (1988), *The Report on 1986 Industrial and Commercial Census - Taiwan District Sample Survey, Industrial Sector*, Vol. 34, Taipei: Directorate-General of Budget, Accounting and Statistics for Taiwan.

Appendix Table B.1
Gross Domestic Product by Manufacturing Branch - Australia, 1974-95 ($Am)
(1984-85 Prices)

Year	Food, Beverages and Tobacco	Textiles, Clothing, Leather and Footwear	Wood, Wood Products, Paper and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Non-Metallic Mineral Products	Basic and Fabricated Metal Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1974	4604	2072	4163	3043	1467	5514	6472	437	27737
1975	4681	1945	4028	2936	1416	5152	6316	446	26903
1976	4817	1963	4102	3031	1460	5078	6255	468	27175
1977	4970	1915	4191	3169	1476	5159	6119	470	27474
1978	5088	1970	4281	3316	1467	5276	6037	493	27927
1979	5148	2052	4493	3462	1536	5647	6293	514	29145
1980	5200	2091	4678	3520	1606	5985	6506	513	30098
1981	5239	2112	4797	3606	1645	6168	6701	528	30797
1982	5240	2048	4664	3577	1547	5784	6465	523	29848
1983	5222	2035	4579	3527	1436	5474	5944	527	28744
1984	5243	2152	4854	3648	1499	5748	6030	565	29738
1985	5305	2296	5202	3645	1662	5989	6206	566	30871
1986	5414	2365	5369	3711	1688	6087	6238	572	31445
1987	5657	2364	5620	4001	1652	6300	6431	617	32642
1988	5918	2409	6041	4219	1807	6734	6859	660	34647
1989	6005	2316	5957	4230	1886	7086	7098	671	35271
1990	6068	2154	5568	4235	1755	7133	6932	644	34562
1991	6174	2089	5321	4274	1620	7002	6628	651	33878
1992	8032	1871	5117	4305	1725	6509	7455	1529	36911
1993	7861	1833	5188	4802	1791	6674	7632	1537	37608
1994	7847	1790	5293	5067	1778	6494	8320	1565	38412
1995	7798	1740	5133	5068	1720	6423	8759	1512	38381

Source: Supplied by Prof. D. S. Prasada Rao and Mr Boon Lee.

Appendix Table B.2
Gross Domestic Product by Manufacturing Branch - Taiwan, 1974-95 ($NTm)
(1984-85 Prices)

Year	Food, Beverages and Tobacco	Textiles, Clothing, Leather and Footwear	Wood, Wood Products, Paper and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Non-Metallic Mineral Products	Basic and Fabricated Metal Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1974	46145	32836	23062	72737	12449	13601	40759	19344	263602
1975	44135	37575	25308	95372	13583	16646	49076	15701	289190
1976	60283	48576	27543	112381	17595	25142	59674	24792	367795
1977	63404	56743	30306	126865	20614	27523	74340	39501	427129
1978	67639	67547	40814	114190	24341	38604	93574	41020	509671
1979	74182	69425	45365	152776	24195	43276	100419	38632	545914
1980	76313	85432	42906	154843	26243	50054	114062	39254	568140
1981	81116	101373	41489	146671	30146	55612	137178	42461	621986
1982	86983	116430	39923	169116	28038	62702	135851	46667	660106
1983	101718	118186	43312	187094	32287	73821	158953	53455	753534
1984	109275	132870	49294	182547	33499	89392	188866	60963	862284
1985	124566	142418	55906	145115	35607	96419	194042	63331	940796
1986	129621	166552	72038	235936	39168	116915	245462	78858	1162171
1987	151183	172762	80457	305095	45176	136622	306017	88998	1343542
1988	149234	162861	77961	303390	51838	154073	338320	90377	1400424
1989	146551	167038	79287	292529	58498	167073	379940	89033	1471728
1990	162096	172614	73815	196404	64658	189186	433253	86214	1562915
1991	163650	177702	76464	544773	68633	211889	482549	82630	1737542
1992	174976	199153	75086	495331	76914	246556	547792	83055	1918370
1993	169456	206002	66502	589621	88983	272478	561935	75499	1981354
1994	171198	178798	61554	502208	92518	282475	593811	67579	2015605
1995	164952	157736	53408	416546	82627	282275	623699	56161	1977416

Sources: Directorate-General of Budget, Accounting and Statistics (1996), *1995 National Income in Taiwan Area of the Republic of China* Republic of China: Executive Yuan; and price indices from Council for Economic Planning and Development (1997), *Taiwan Statistical Databook 1997*, Republic of China: Council for Economic Planning and Development.

Appendix Table B:3
Gross Domestic Product by Manufacturing Industry - Australia, 1974-95 ($Am)
(1991-92 Prices)

Year	Food, Beverages and Tobacco	Textiles	Clothing and Footwear	Wood and Wood Products	Paper and Paper Products	Chemicals, Coal and Petroleum Products	Non-Metallic Mineral Products	Basic Metal Products	Other Machinery & Equipment	Transport Machinery	Other Manufactures	Total Manufacturing
1974	5942	1111	1815	2417	3646	3103	2238	4451	5198	5174	1953	88821
1975	6439	1232	1862	2475	3556	3088	2245	4132	5031	5079	1987	81018
1976	6665	1170	1760	2540	3732	3312	2378	4408	4992	5232	2060	75432
1977	7217	1019	1705	2466	3692	3299	2167	4001	6129	4482	2079	69056
1978	7023	1087	1799	2552	3884	3473	2225	4269	5051	4557	2249	62236
1979	6971	1114	1853	2634	4143	3566	2374	4658	5203	4963	2278	57891
1980	7170	1108	1888	2729	4248	3556	2434	4878	5529	4697	2348	54949
1981	7477	1132	1883	2772	4358	3679	2489	4875	5770	4983	2450	48643
1982	7502	1043	1760	2447	4129	3571	2143	4218	4829	4737	2231	44078
1983	7337	1088	1895	2569	4306	3703	2156	4676	4575	4656	2287	43125
1984	7399	1199	1960	2694	4687	3800	2330	5107	4819	5082	2423	42114
1985	7517	1220	2190	3065	4772	3762	2648	5036	4874	5043	2207	40258
1986	7671	1303	2042	2777	5091	3911	2408	5092	5200	4743	2550	38937
1987	8240	1316	2084	3117	5510	4197	2537	5204	5509	4858	2739	38666
1988	8497	1322	2161	3235	5869	5237	2872	5465	6030	5621	2870	36960
1989	10262	1317	2110	3205	5756	5522	3438	7235	5581	6384	3098	34686
1990	10705	1328	1947	2912	5589	5645	3076	7423	5626	5897	3106	33878
1991	10600	1367	1832	2835	5341	5641	2938	7515	5529	5392	3041	36039
1992	8640	1068	1654	1602	5725	6491	2583	6186	6186	5154	3570	36338
1993	9105	1310	1700	1558	6215	7340	2678	6377	6377	4916	3911	36298
1994	9478	1246	1615	1706	6534	7334	2672	6211	6388	4846	4290	35370
1995	9850	1181	1529	1855	6854	7328	2665	6852	6399	4776	4669	35501

Sources: Gross Product at current prices from *Manufacturing Industry - Australia* ABS Cat. No. 8221.0, 1990-91 and 1991-92; *Australian National Accounts - Input-Output Tables* 1992-93 (Cat. No. 5209.0), deflated with Manufacturing Price Indices from *Yearbook Australia,* various issues; Gross product at constant prices from *Constant Price Estimates of Manufacturing Production, Australia* ABS Cat. No. 8211.0, 1975-76 to 1989-90.

Appendix Table B:4
Gross Domestic Product by Manufacturing Industry - Taiwan, 1974-95 ($NTm)
(1991-92 Prices)

Year	Food, Beverages and Tobacco	Textiles	Clothing and Footwear	Wood and Wood Products	Paper and Paper Products	Chemicals, Coal and Petroleum Products	Non-Metallic Mineral Products	Basic Metal Products	Other Machinery & Equipment	Transport Machinery	Other Manufactures	Total Manufacturing
1974	36350	16273	14692	11670	12483	27957	10059	9351	24922	14487	15092	240031
1975	34208	22321	12768	12732	13757	30648	12235	9429	26807	19867	12992	263331
1976	47699	27764	17853	12564	16260	35475	15862	12858	35827	20745	20815	334907
1977	50048	31208	21896	12832	18888	39549	18405	13556	42421	28034	33218	388936
1978	53216	37652	25517	17868	24871	51243	21780	22249	54623	33477	34342	464096
1979	59080	37495	27328	19439	28335	55797	21409	25572	58893	34988	33012	497099
1980	65986	46066	33495	16006	28994	55834	24783	26716	67840	38625	33703	517337
1981	74134	53323	40898	21133	22341	32745	29330	29448	77020	50607	36984	566369
1982	79599	56870	51021	19836	22049	36546	27243	36024	74646	51652	40215	601080
1983	93022	58270	51217	22584	22829	42261	31421	42101	91383	56134	46601	686154
1984	99873	66123	57006	25879	25709	54495	32056	50588	115970	58931	53155	785179
1985	113728	76403	55530	29455	29050	63078	33845	52420	122614	56827	55500	856671
1986	118346	89569	64727	40096	35297	85300	38058	62981	158367	67898	66983	1058251
1987	138002	98035	62004	47589	36683	101612	44209	72914	200500	80282	74130	1223404
1988	136143	94075	56791	43856	37747	108817	50091	83422	226535	83321	76263	1275199
1989	133694	96512	58221	43770	39231	113189	57925	89246	250073	97732	73998	1340128
1990	147837	100271	59657	38871	38379	121703	63911	97019	288565	108011	71482	1423161
1991	149283	109533	55078	41331	38688	133234	67980	104420	322995	118689	68340	1582173
1992	159483	130809	53745	39175	39408	150623	79550	118150	364812	136727	69738	1746831
1993	154466	133379	57760	31698	38178	154528	92523	136398	384429	130129	63710	1804183
1994	155803	121064	44601	26617	37867	181672	91639	140632	409420	134687	57118	1835372
1995	150322	106039	40085	23418	32475	193328	81842	142350	441689	130075	48755	1800598

Sources: Directorate-General of Budget, Accounting and Statistics (1996), *1995 National Income in Taiwan Area of the Republic of China* Republic of China: Executive Yuan; and price indices from Council for Economic Planning and Development (1997), *Taiwan Statistical Databook 1997*, Republic of China: Council for Economic Planning and Development.

Appendix Table C.1
Employment Numbers by Manufacturing Branch, Australia, 1974-95

Year	Food, Beverages and Tobacco	Textiles, Clothing and Footwear	Wood, Wood Products Paper, and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Non-Metallic Mineral Products	Basic and Fabricated Metal Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1974	196866	133526	181179	63949	50971	208419	341550	68777	1559942
1975	196899	132999	176357	60293	48367	198736	320411	66378	1509796
1976	195881	123205	175268	60429	47596	196707	311431	65314	1474304
1977	189020	118449	171753	61673	45730	191824	291344	62891	1422886
1978	189655	117408	172500	61777	44987	195853	297199	64508	1433795
1979	186353	117513	178792	60294	45777	203092	296312	66051	1450489
1980	183962	115373	181245	59671	45855	209532	289829	64641	1446726
1981	178732	113452	183332	60218	45957	212446	294397	66125	1451443
1982	174500	102600	171700	58300	40900	184800	261200	58800	1327100
1983	168900	106900	170900	55500	38800	172500	246700	58000	1296000
1984	167100	108800	176300	55200	39100	170000	248100	58700	1308400
1985	167900	108000	178150	54500	39300	169100	243000	59300	1305400
1986	168700	106800	180000	53800	39500	168200	237900	59900	1301600
1987	175500	110600	191500	54300	40500	179500	246300	65500	1365800
1988	177800	107200	204200	53800	43300	174100	258300	69000	1399100
1989	172500	95200	191200	51700	42300	173800	238100	63400	1314600
1990	169200	84100	179200	51900	39700	166100	212900	60200	1226600
1991	162300	76000	172000	50500	37600	159900	195800	58176	1160276
1992	159362	71756	141887	48963	38394	143146	188379	47910	1053440
1993	164200	65348	148011	47850	38200	145578	275435	53983	1151964
1994	162522	72215	152961	48089	38735	145994	283220	53874	1182786
1995	159929	69787	151128	47619	35604	144995	202174	50902	1083053

Sources: *Manufacturing Industry: Details of Operations, Australia*, ABS Cat. No. 8203.0, various issues; *Manufacturing Industry, Australia*, ABS Cat. No. 8221.0, various issues, Canberra: AGPS.

Appendix Table C:2
Employment Numbers by Manufacturing Branch, Taiwan, 1974-95

Year	Food, Beverages and Tobacco	Textiles, Clothing and Footwear	Wood, Wood Products Paper, and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Non-Metallic Mineral Products	Basic and Fabricated Metal Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1974	120300	391354	149616	226014	74981	96093	355516	61031	1474905
1975	109949	392036	143592	235730	74330	97472	314745	61341	1429195
1976	110958	425623	159276	265201	77599	113306	382375	73478	1607816
1977	115600	439527	173863	293282	85837	131363	415217	77947	1732636
1978	119227	459884	189255	319678	90612	143024	482358	78867	1882905
1979	123231	462389	194021	333183	93664	160133	514171	82040	1962832
1980	127010	453126	193276	358124	98758	173968	544045	88018	2036325
1981	121584	462111	201609	360637	103079	189171	544363	95259	2077813
1982	118512	465471	204673	373546	103946	198337	508943	107347	2080775
1983	119231	477414	214232	384195	105739	214562	551907	115857	2183137
1984	129387	501965	229236	432193	110411	236272	647942	134142	2421548
1985	135987	529861	236864	451455	108924	251605	648876	137719	2501291
1986	135487	523830	252743	466333	109819	268409	706907	150536	2614064
1987	134816	508631	261907	473363	109443	283502	768755	156502	2696919
1988	128160	493558	265601	476086	107632	297269	786926	149909	2705141
1989	126524	448842	258035	450709	105277	305782	778246	138973	2612388
1990	128254	387220	234153	406501	100751	299112	766084	122935	2445010
1991	127470	367979	225794	392520	99023	304854	764720	117285	2399645
1992	130124	353573	221772	387208	101079	320661	783289	112515	2410221
1993	130863	339023	215692	379171	103984	334603	791321	102478	2397135
1994	133284	337729	216634	385454	108706	350038	807283	99504	2438632
1995	129319	318053	210125	380294	104253	345573	817630	94412	2399659

Source: *Monthly Bulletin of Earnings and Productivity Statistics, Taiwan Area, Republic of China*, *February 1995*, no. 256, Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan.

Appendix Table C:3
Employment Numbers by Manufacturing Industry, Australia, 1974-95

Year	Textiles	Clothing and Footwear	Wood and Wood Products	Paper and Paper Products	Chemicals, Coal and Petroleum Products	Non-Metallic Mineral Products	Basic Metal Products	Other Machinery and Equipment	Transport Machinery	Other Manufactures
1974	43231	90295	78109	103070	63949	50971	98267	194122	147428	68777
1975	43976	89023	78468	97889	60293	48367	93915	178168	142243	66378
1976	39185	84020	77883	97385	60429	47596	93804	168200	143231	65314
1977	37070	81379	74089	97664	61673	45730	88828	157980	133364	62891
1978	36528	80880	74458	98042	61777	44987	90001	160402	136797	64508
1979	37499	80014	77213	101579	60294	45777	94107	159428	136884	66051
1980	36923	78450	78835	102410	59671	45855	96482	161392	128437	64641
1981	35945	77507	80419	102913	60218	45957	96114	162930	131467	66125
1982	32600	70000	71000	100700	58300	40900	83000	140200	121000	58800
1983	33200	73700	71300	99600	55500	38800	78200	127700	119000	58000
1984	34000	74800	73400	102900	55200	39100	76200	127300	120800	58700
1985	34000	74000	73750	104400	54500	39300	74750	127000	116000	59300
1986	33600	73200	74100	105900	53800	39500	73300	126700	111200	59900
1987	35400	75200	82000	109500	54300	40500	74700	135000	111300	65500
1988	32600	74600	89400	114800	53800	43300	62100	140800	117500	69000
1989	30300	64900	83900	107300	51700	42300	67500	131500	106600	63400
1990	28300	55800	75900	103300	51900	39700	69300	121600	91300	60200
1991	26200	49800	71700	100300	50500	37600	71100	114200	81600	58176
1992	24357	47399	39724	102163	48963	38394	60393	108713	79666	47910
1993	26431	38917	44133	103878	47850	38200	106062	195546	79889	53983
1994	26446	45769	45712	107249	48089	38735	54316	201495	81725	53874
1995	24614	45173	43065	108063	47619	35604	53818	120181	81993	50902

Sources: *Manufacturing Industry: Details of Operations, Australia* (Cat. No. 8203.0), various issues, Canberra:AGPS; *Manufacturing Industry: Australia*, (Cat. No. 8221.0), various issues, Canberra:AGPS.

Appendix Table C:4
Employment Numbers by Manufacturing Industry, Taiwan, 1974-95

Year	Textiles	Clothing and Footwear	Wood and Wood Products	Paper and Paper Products	Chemicals, Coal and Petroleum Products	Non-Metallic Mineral Products	Basic Metal Products	Other Machinery and Equipment	Transport Machinery	Other Manufactures
1974	283235	86255	71893	39462	80440	74981	41157	282660	61438	61031
1975	282680	88766	67120	36947	80535	74330	41390	242417	59165	61341
1976	305877	93262	75195	39135	85748	77599	43118	300944	64650	73478
1977	306997	98959	80752	41888	88333	85837	45987	326047	69798	77947
1978	316264	103642	80588	43550	99376	90612	53270	372240	86238	78867
1979	315820	102020	78790	45663	106636	93664	56501	393302	97771	82040
1980	303603	103379	71417	46844	115254	98758	64197	417020	102515	88018
1981	297655	119154	71682	48679	104875	103079	70214	411059	108001	95259
1982	289619	128169	70213	49473	106573	103946	71762	381591	104448	107347
1983	290580	131008	75607	50083	108474	105739	69749	422021	106540	115857
1984	300523	142907	77227	54785	116565	110411	72312	504079	115142	134142
1985	310309	155139	74602	57517	122035	108924	74935	494706	121467	137719
1986	300857	153591	78179	59750	124848	109819	77687	542865	127758	150536
1987	293292	143991	81722	61557	128795	109443	80371	592930	135711	156502
1988	283373	139608	82803	63639	133050	107632	85919	609795	136238	149909
1989	260302	123906	77195	61785	135189	105277	89398	602849	135162	138973
1990	222477	109057	62425	59967	136240	100751	86991	593726	132847	122935
1991	209895	105464	55025	60441	134840	99023	89428	591836	132281	117285
1992	206483	97474	45933	62852	137885	101079	97712	606229	138050	112515
1993	200643	91740	38483	63274	140935	103984	105331	614876	142500	102478
1994	204688	88977	35857	63960	144941	108706	109389	630028	143842	99504
1995	196379	81683	31783	65327	146277	104253	109033	642804	141952	94412

Sources: Republic of China, *Monthly Bulletin of Earnings and Productivity Statistics*, various issues, Taipai:Republic of China.

Appendix Table D.4
Annual Hours Worked by Manufacturing Sub-Branch - Taiwan, 1975-92

Year	Food, Beverages & Tobacco	Textiles, Clothing & Footwear	Wood, Wood Products, Paper, Paper Products	Chemicals, chemical products, Rubber & Plastic Products	Non-Metallic Mineral Products	Basic Metal Products & Fabricated Metal Products	Transport Equipment, Other Machinery & Equipment	Miscellaneous Manufacturing	Total Manufacturing
1975	2652	2622	2832	2702	2496	2682	2604	2628	2640
1976	2676	2616	2838	2724	2520	2742	2632	2652	2676
1977	2712	2640	2808	2734	2532	2646	2732	2460	2676
1978	2706	2628	2874	2734	2556	2652	2632	2616	2652
1979	2682	2682	2808	2645	2568	2670	2612	2592	2640
1980	2694	2682	2766	2635	2628	2700	2604	2604	2652
1981	2538	2514	2598	2484	2520	2538	2472	2484	2520
1982	2562	2578	2636	2491	2490	2512	2404	2520	2508
1983	2468	2548	2645	2474	2501	2494	2465	2455	2508
1984	2506	2576	2672	2484	2480	2585	2474	2495	2532
1985	2433	2530	2545	2425	2460	2504	2405	2398	2472
1986	2410	2557	2601	2454	2478	2536	2455	2441	2508
1987	2442	2556	2593	2448	2514	2545	2483	2460	2509
1988	2398	2526	2519	2459	2504	2515	2443	2461	2478
1989	2375	2483	2487	2441	2460	2521	2408	2424	2443
1990	2381	2470	2470	2417	2454	2494	2372	2377	2422
1991	2362	2492	2464	2412	2479	2467	2378	2372	2424
1992	2366	2466	2458	2417	2483	2504	2381	2370	2424

Source : Directorate-General of Budget, Accounting and Statistics (1993), *Monthly Bulletin of Earnings and Productivity Statistics, Taiwan Area - Republic of China*, Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, various issues.

Appendix Table D.2
Total Annual Hours Worked by Manufacturing Branch - Taiwan, 1975-92
('000)

Year	Food, Beverages & Tobacco	Textiles, Clothing & Footwear	Wood, Wood Products, Paper, Paper Products	Chemicals, chemical products, Rubber & Plastic Products	Non-Metallic Mineral Products	Basic Meta Products & Fabricated Metal Products	Transport Equipment, Other Machinery & Equipment	Miscellaneous Manufacturing	Total Manufacturing
1975	2652	2622	2832	2702	2496	2682	2604	2628	2640
1976	2676	2616	2838	2724	2520	2742	2632	2652	2676
1977	2712	2640	2808	2734	2532	2646	2732	2460	2676
1978	2706	2628	2874	2734	2556	2652	2632	2616	2652
1979	2682	2682	2808	2645	2568	2670	2612	2592	2640
1980	2694	2682	2766	2635	2628	2700	2604	2604	2652
1981	2538	2514	2598	2484	2520	2538	2472	2484	2520
1982	2562	2578	2636	2491	2490	2512	2404	2520	2508
1983	2468	2548	2645	2474	2501	2494	2465	2455	2508
1984	2506	2576	2672	2484	2480	2585	2474	2495	2532
1985	2433	2530	2545	2425	2460	2504	2405	2398	2472
1986	2410	2557	2601	2454	2478	2536	2455	2441	2508
1987	2442	2556	2593	2448	2514	2545	2483	2460	2509
1988	2398	2526	2519	2459	2504	2515	2443	2461	2478
1989	2375	2483	2487	2441	2460	2521	2408	2424	2443
1990	2381	2470	2470	2417	2454	2494	2372	2377	2422
1991	2362	2492	2464	2412	2479	2467	2378	2372	2424
1992	2366	2466	2458	2417	2483	2504	2381	2370	2424

Source: Directorate-General of Budget, Accounting and Statistics (1993), *Monthly Bulletin of Earnings and Productivity Statistics, Taiwan Area - Republic of China*, Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, various issues.

Appendix Table D.3
Annual Hours Worked by Manufacturing Industry - Australia, 1975-92
('000)

Year	Food, Beverages & Tobacco	Textiles	Clothing & Footwear	Wood & Wood Products	Paper & Paper Products	Chemicals, Coal & Petroleum Products	Non-Metallic Mineral Products	Basic Metal Products	Other Machinery & Equipment	Transport Machinery	Miscellaneous Manufactures	Total Manufacturing
1975	2200	1914	1914	2200	2200	2054	2111	2246	2101	2101	2111	2111
1976	2153	2059	2059	2153	2153	2132	2153	2200	2158	2111	2153	2153
1977	2142	2075	2075	2142	2142	2132	2148	2200	2148	2106	2148	2148
1978	2054	2179	2179	2163	2163	2090	2116	2191	2127	2127	2116	2116
1979	2059	2231	2231	2111	2111	2038	2096	2186	2101	2101	2096	2096
1980	2145	2158	2158	2098	2098	2077	2137	2181	2140	2111	2137	2137
1981	2135	2192	2192	2088	2088	2062	2137	2163	2150	2135	2137	2137
1982	2098	2171	2171	2062	2062	2038	2059	2105	2100	2090	2059	2098
1983	2062	2150	2150	2036	2036	2015	2096	2046	2049	2046	2096	2059
1984	2081	2122	2122	2049	2049	2028	2090	2075	2081	2100	2090	2077
1985	2101	2093	2093	2062	2062	2041	2098	2103	2114	2153	2098	2096
1986	2124	2114	2114	2051	2051	2075	2148	2111	2090	2077	2148	2090
1987	2124	2114	2114	2041	2041	2033	2174	2109	2103	2106	2174	2098
1988	2153	2122	2122	2106	2106	2096	2075	2205	2163	2148	2075	2148
1989	2163	2122	2122	2096	2096	2127	2101	2262	2194	2189	2101	2174
1990	2101	2064	2064	2044	2044	2049	2122	2085	2070	2049	2122	2075
1991	2116	2049	2049	2038	2038	2116	1985	2194	2111	2080	1985	2101
1992	2142	2080	2080	2070	2070	2111	2028	2226	2132	2122	2028	2122

Notes: Hours worked by 'Textiles, Clothing & Footwear' used as a proxy for 'Textiles' and 'Clothing & Footwear'; hours worked by 'Paper & Paper Products' used as a proxy for 'Wood and Wood Products'; hours worked by 'Other Manufacturing' used as a proxy for 'Non-Metallic Mineral Products'; hours worked by 'Total Metal Products' used as a proxy for 'Other Machinery & Equipment'.

Source: *Distribution and Composition of Employee Earnings and Hours - Australia*, ABS Cat. No. 6306.0 Canberra: AGPS.

Appendix Table D.4
Annual Hours Worked by Manufacturing Industry - Taiwan, 1975-92
('000)

Year	Food, Beverages & Tobacco	Textiles	Clothing & Footwear	Wood & Wood Products	Paper & Paper Products	Chemicals, Coal & Petroleum Products	Non-Metallic Mineral Products	Basic Metal Products	Other Machinery & Equipment	Transport Machinery	Miscellaneous Manufactures	Total Manufacturing
1975	2652	2688	2556	2868	2796	2712	2496	2700	2562	2688	2628	2640
1976	2676	2688	2544	2844	2832	2748	2520	2760	2592	2712	2652	2676
1977	2712	2700	2580	2808	2808	2756	2532	2580	2742	2712	2460	2676
1978	2706	2640	2616	2904	2844	2748	2556	2676	2592	2712	2616	2652
1979	2682	2676	2688	2808	2808	2620	2568	2712	2568	2700	2592	2640
1980	2694	2700	2664	2772	2760	2596	2628	2700	2586	2640	2604	2652
1981	2538	2508	2520	2640	2556	2448	2520	2532	2472	2472	2484	2520
1982	2562	2539	2617	2686	2586	2459	2490	2513	2408	2396	2520	2508
1983	2468	2575	2520	2648	2641	2427	2501	2466	2458	2479	2455	2508
1984	2506	2590	2563	2674	2671	2452	2480	2596	2484	2455	2495	2532
1985	2433	2556	2503	2554	2536	2378	2460	2531	2392	2432	2398	2472
1986	2410	2570	2544	2644	2558	2365	2478	2556	2467	2432	2441	2508
1987	2442	2556	2556	2626	2560	2382	2514	2586	2480	2489	2460	2509
1988	2398	2540	2512	2537	2502	2430	2504	2550	2446	2437	2461	2478
1989	2375	2502	2465	2488	2486	2429	2460	2574	2404	2416	2424	2443
1990	2381	2485	2455	2447	2494	2403	2454	2536	2375	2365	2377	2422
1991	2362	2514	2470	2444	2484	2376	2479	2484	2381	2374	2372	2424
1992	2366	2494	2438	2452	2465	2386	2483	2573	2380	2384	2370	2424

Source: Directorate-General of Budget, Accounting and Statistics (1993), *Monthly Bulletin of Earnings and Productivity Statistics, Taiwan Area - Republic of China*, Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan, various issues.

Appendix Table E.1
Extrapolations of 1986 Value Added Per Hour Worked Benchmark by Manufacturing Industry, Taiwan/Australia, 1975-92
Australia = 100

	Textiles	Clothing & Footwear	Wood & Wood Products	Paper & Paper Products	Chemicals, Petroleum & Coal Products	Basic Metal Products	Transport Equipment	Other Machinery & Equipment
1975	25.4	29.5	4.8	24.6	121.5	49.6	37.7	58.4
1976	29.5	42.3	4.0	25.1	126.7	58.2	35.1	74.5
1977	36.0	48.6	3.8	27.8	140.6	64.3	47.6	115.3
1978	41.8	52.8	5.0	33.4	141.1	83.4	46.9	105.6
1979	42.2	54.9	5.7	34.9	144.8	85.0	39.4	95.1
1980	51.1	62.4	5.1	34.6	135.5	76.6	42.2	88.7
1981	62.9	70.3	7.0	27.0	115.8	81.4	54.7	92.0
1982	66.4	75.2	6.6	26.4	121.4	86.4	56.5	77.8
1983	64.7	74.2	6.6	24.8	130.9	96.5	57.0	81.3
1984	64.7	72.1	7.3	24.1	130.3	96.1	53.3	74.9
1985	71.1	57.9	8.0	27.4	147.9	99.4	48.8	80.0
1986	79.9	71.8	11.1	30.1	202.5	111.0	54.6	90.1
1987	94.1	73.5	12.4	28.8	215.2	122.3	58.8	98.1
1988	86.5	67.9	12.7	29.7	177.0	109.9	57.8	89.0
1989	91.5	71.2	13.0	30.4	163.5	94.3	56.1	88.9
1990	101.0	75.4	14.1	29.6	148.5	98.6	55.9	92.6
1991	103.2	67.4	16.5	30.1	212.6	112.4	61.0	91.5
1992	152.5	77.2	18.6	28.7	186.4	117.6	69.8	95.9

Sources: Benchmark gross value added and hours worked from: *1986-87 Manufacturing Industry: Details of Operations, Australia* (ABS Cat. No. 8203.0), Canberra: AGPS; and *Distribution and Composition of Employee Earnings and Hours* (ABS Cat. No. 6306.0), various issues, for Australia; and the *1986 Industrial and Commercial Census* and *Monthly Bulletin of Earnings and Productivity Statistics* for Taiwan. Gross value added time series and hours worked from ABS Cat. No. 6306.0 for Australia and the *1995 National Income in Taiwan Area of the Republic of China* (deflated with price indices from the *1996 Taiwan Statistical Databook*) for gross value added time series and hours worked from *Monthly Bulletin of Earnings and Productivity Statistics for Taiwan.*

Appendix Table F.1
Labour Productivity Indices by Manufacturing Branch, Australia, 1974-95
(1986 = 100)

	Food, Beverages and Tobacco	Textiles, Clothing, Leather and Footwear	Wood, Wood Products Paper, and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Basic and Fabricated Metals	Non-Metallic Mineral Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1974	72.9	70.1	77.0	69.0	73.1	67.4	72.3	66.6	73.6
1975	74.1	66.1	76.6	70.6	71.6	68.5	75.2	70.5	73.8
1976	76.6	72.0	78.5	72.7	71.3	71.8	76.6	75.1	76.3
1977	81.9	73.0	81.8	74.5	74.3	75.5	80.1	78.4	79.9
1978	83.6	75.8	83.2	77.8	74.4	76.3	77.5	80.0	80.6
1979	86.1	78.9	84.3	83.2	76.8	78.5	81.0	81.6	83.2
1980	88.1	81.8	86.5	85.5	78.9	82.0	85.6	83.2	86.1
1981	91.3	84.1	87.7	86.8	80.2	83.7	86.8	83.7	87.8
1982	93.6	90.1	91.1	88.9	86.5	88.5	94.4	93.3	93.1
1983	96.3	86.0	89.8	92.1	87.7	86.6	91.9	95.3	91.8
1984	97.8	89.3	92.3	95.8	93.4	89.7	92.7	100.9	94.1
1985	98.5	96.0	97.9	96.9	97.9	99.0	97.4	100.1	97.9
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	100.4	96.5	98.4	106.8	97.0	95.4	99.6	98.7	98.9
1988	103.7	101.5	99.2	113.7	106.9	97.7	101.3	100.3	102.5
1989	108.5	109.9	104.4	118.6	112.7	104.3	113.7	110.9	111.1
1990	111.7	115.7	104.2	118.3	118.7	103.4	124.2	112.2	116.6
1991	118.5	124.1	103.7	122.7	121.0	100.8	129.1	117.2	120.9
1992	157.1	117.8	120.9	127.5	125.6	105.1	150.9	134.5	145.0
1993	149.2	126.7	117.5	145.5	126.7	109.7	158.1	128.4	135.1
1994	150.4	111.9	116.0	152.8	122.9	107.4	161.6	114.4	134.4
1995	151.9	112.6	113.9	154.3	122.4	113.0	165.2	111.4	146.7

Sources: Manufacturing Branch GDP from Appendix Table B:1; Employment from Appendix Table C:1

Appendix Table F.2
Labour Productivity Indices by Manufacturing Branch, Taiwan, 1974-95
(1986 = 100)

	Food, Beverages and Tobacco	Textiles, Clothing, Leather and Footwear	Wood, Wood Products Paper, and Paper Products	Chemicals, Chemical Products, Rubber and Plastic Products	Basic and Fabricated Metals	Non-Metallic Mineral Products	Transport Equipment and Other Machinery	Other Manufacturing	Total Manufacturing
1974	40.1	26.4	54.1	63.6	32.5	46.6	32.4	60.5	40.2
1975	42.0	30.1	61.8	80.0	39.2	51.2	44.5	48.9	45.5
1976	56.8	35.9	60.7	83.8	50.9	63.6	44.6	64.4	51.5
1977	57.3	40.6	61.2	85.5	48.1	67.3	51.3	96.7	55.4
1978	59.3	46.2	75.7	70.6	62.0	75.3	55.8	99.3	60.9
1979	62.9	47.2	82.0	90.6	62.0	72.4	55.9	89.9	62.6
1980	62.8	59.3	77.9	85.5	66.1	74.5	60.0	85.1	62.8
1981	69.7	69.0	72.2	80.4	67.5	82.0	72.2	85.1	67.3
1982	76.7	78.7	68.4	89.5	72.6	75.6	76.4	83.0	71.4
1983	89.2	77.9	70.9	96.3	79.0	85.6	82.2	88.1	77.6
1984	88.3	83.3	75.4	83.5	86.9	85.1	83.3	86.8	80.1
1985	95.7	84.5	82.8	63.5	88.0	91.7	86.0	87.8	84.6
1986	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1987	117.2	106.8	107.8	127.4	110.6	115.7	114.7	108.6	112.1
1988	121.7	103.8	103.0	126.0	119.0	135.0	123.9	115.1	116.4
1989	121.1	117.0	107.8	128.3	125.4	155.8	140.7	122.3	126.7
1990	132.1	140.2	110.6	95.5	145.2	179.9	162.9	133.9	143.8
1991	134.2	151.9	118.8	274.3	159.6	194.3	182.1	134.5	162.9
1992	140.6	177.2	118.8	252.8	176.5	213.3	201.1	140.9	179.0
1993	135.4	191.1	108.2	307.4	187.0	239.9	202.7	140.6	185.9
1994	134.3	166.5	99.7	257.5	185.3	238.6	209.6	129.6	185.9
1995	133.3	156.0	89.2	216.5	187.5	222.2	217.1	113.6	185.4

Sources: Manufacturing Branch GDP from Appendix Table B:2; Employment from Appendix Table C:2

Appendix Table G:1
Extrapolation of Benchmark Unit Value Ratio by Manufacturing Industry, Taiwan/Australia, 1974-95
Australia = 100

	Textiles	Clothing & footwear	Wood products	Paper products	Basic Metal products	Transport Equipment
1974	45.0	17.8	117.2	46.9	58.3	35.7
1975	33.9	14.7	91.0	34.7	38.6	29.9
1976	34.0	13.5	87.9	32.9	34.4	26.8
1977	30.9	13.0	85.5	30.8	33.8	25.1
1978	30.0	12.7	86.0	30.0	35.2	24.5
1979	29.0	13.2	103.5	31.6	35.9	26.1
1980	27.3	13.3	102.0	34.2	38.5	26.7
1981	26.3	13.3	94.5	31.4	31.9	25.5
1982	23.3	13.2	87.1	26.9	27.6	23.3
1983	21.6	12.8	80.3	25.6	25.9	22.1
1984	21.8	12.5	72.6	26.1	25.0	21.2
1985	19.0	11.8	63.5	23.2	23.2	19.2
1986	17.6	10.6	58.3	21.8	21.3	17.2
1987	15.4	10.1	54.1	21.4	18.1	16.0
1988	13.7	9.0	51.7	20.6	17.4	15.8
1989	13.0	8.1	48.6	20.2	17.2	15.0
1990	12.8	8.0	48.8	18.6	16.1	14.5
1991	13.4	7.8	48.8	18.1	16.9	14.2
1992	12.4	7.5	46.7	16.9	15.5	13.8
1993	12.0	7.7	50.8	16.3	16.0	14.0
1994	12.6	7.7	51.5	18.0	14.8	14.2
1995	13.7	7.6	54.4	20.2	16.2	14.5

Source: Directorate-General of Budget, Accounting and Statistics (1988), *The Report on 1986 Industrial and Commercial Census - Taiwan District Sample Survey Industrial Sector*, Vol. 34, Taipei: Directorate-General of Budget, Accounting and Statistics, Executive Yuan; and *1986-87 Manufacturing Commodities: Principal Articles Produced. Australia* (ABS Cat. No. 8203.0), Canberra: AGPS; Producer price indices from *Yearbook Australia* (ABS Cat. No. 1301.0), various issues. Canberra: AGPS for Australia; and the *1996 Taiwan Statistical Data book* for Taiwan.